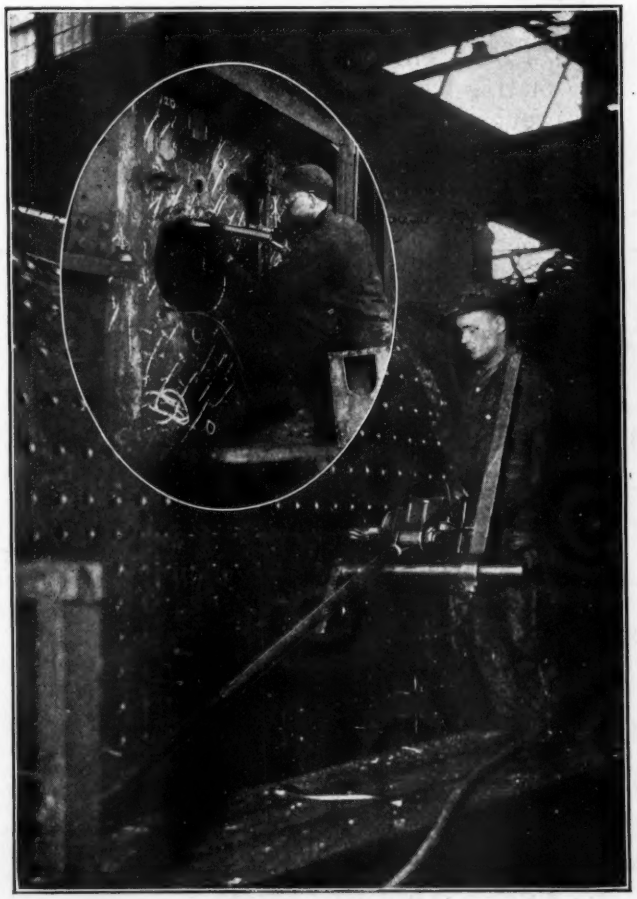
Engineering Library
APP 19 18.
UNIV MICH

COMPRESSED AIR MAGAZINE

DEVOTED TO THE USEFUL APPLICATIONS OF COMPRESSED AIR

Vol. xxiii APRIL, 1918 No. 4



"LITTLE DAVID"

PNEUMATIC TOOLS

Drills
Grinders
Riveters
Chippers
Scalers
Calkers
Wood Borers
Sand Rammers
Air Hoists

Ask For the Complete Catalog

INGERSOLL—RAND COMPANY

New York ——— London

OVER 15,000 COPIES THIS ISSUE

Published by THE COMPRESSED AIR MAGAZINE CO., Easton, Pa.

NEW YORK, Bowling Green Building LONDON, 165 Queen Victoria Street

Classified Buyers' Guide, Page 14. Index to Advertisers, Page 11.

The STEARNS-ROGER Mfg. Co.

OF DENVER, COLORADO

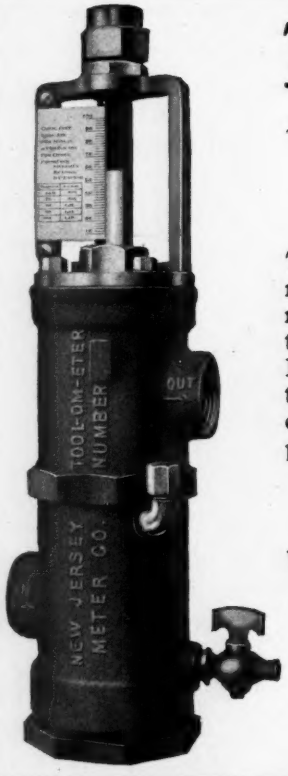
can assist you in securing a substantial bonus payable for the highest grade

Manganese-Tungsten and Chromite

concentrates. These are almost invariably slightly magnetic and by means of

The Wetherill Magnetic Separator

garnets, sulphides or other interfering minerals can be readily eliminated. More ***Wetherill*** machines are being manufactured for this purpose at present than in all previous years combined.



THE TOOL-OM-ETER

The wind bloweth where it listeth
And what do you care?
But COMPRESSED AIR costs money
And the AIR goes WHERE?

This little meter gives you the answer. Shows ***at a glance*** how much air is used by your sluggers, guns, jacks, japs, giants, rammers, riveters, motors, etc.—when they are new, after a month, three months, before and after overhauling and putting in new parts. Enables you to locate and remove leaks, losses and "air eaters" and to keep your equipment in effective and economical working condition. You can stop losses, decrease costs and increase your output with the same compressor capacity.

"The day of guesswork is past."

Write for further information stating what uses you make of Compressed Air.

ASK FOR BULLETIN 5-A.

NEW JERSEY METER CO.

PLAINFIELD, NEW JERSEY

COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Vol. xxiii APRIL, 1918 No. 4

FINE CONTROL OF AIR CHARGE

COMPRESSED AIR IN THE WAR

From the very beginning of the war compressed air was sure of a job at the front, and as long as the strife continues it will be doing its bit. Its employment is not contingent upon emergencies that may arise but is a part of the everyday routine of army operations. As modern war equipment is so largely mechanical there is a large demand for the entire line of pneumatic tools and they are

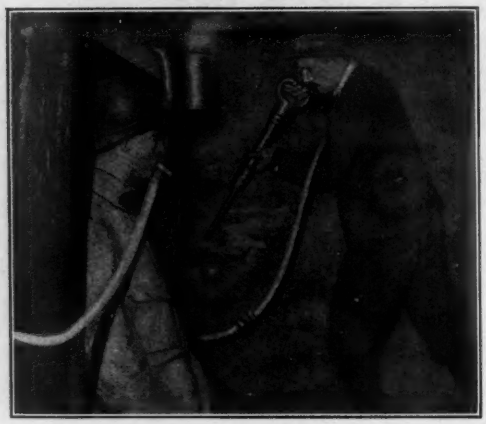


FIG. 1

purchased and put into service by the thousand, with ample compressor capacity, in small units, for driving them. Many of these little compressors are mounted upon motor trucks which can go anywhere, and those of a somewhat larger type, mostly electric driven, are always near the trenches.

For trenching is practically all mining work involving much rock cutting and tunnel driving which must be done with a rush. Of the photos which come to us from the war, many of them most satisfying and realistic views of what is actually going on, it is much to be regretted that, as one of the imperative condition of their transmission, no story comes with them. For instance, Figs. 1 and 2, here reproduced from the *Scientific American*, Feb. 23, show us two bona fide war scenes from "somwhere in France," and they might as well be "somewhere in Montana" so far as they tell us anything. Fig. 1 will be recognized as a Crown Coal Pick, and Fig. 2 as a Jackhamer, both giving good account of themselves wherever they are.

Another most interesting and now most effective and responsible use of compressed air is for the mortars which drop grenades into the trenches. For this service the air proves to be much better adapted than any type of explosive, not only for its noiselessness but also for the precise adjustment and control of its action. Although the range of these air mortars is short, precision is required for their delivery as much as for the long range guns. The point at which the projectile is dropped and the angle at which it is delivered are determined not only by the angle of elevation of the piece but also by the pressure and volume of the charge of air, and these particulars can now be finely adjusted to the requirements and varied as may be with each discharge.

In Fig. 3 is seen an air mortar on trial. A double result is in fact being secured. Not only are all the particulars concerning the action and delivery of the piece being ascertained but also the judgment of the men who are to manipulate it is being developed. To those who stand in rear of the piece the entire flight of the projectile is perfectly visible.

These compressed air mortars have been rapidly improved under the suggestions of experience and one of the latest is seen in Fig. 4. At the left is seen a portable tank which may be charged with air perhaps up to a pressure of 2,000 pounds, enough for several shots. The pressure required for a single discharge may be not more than 100 pounds, varying with the distance or angle of delivery. At the side of the main gun barrel is an auxiliary chamber to hold the individual charge of air. At the top of the pressure tank, near the hand of the operator, are seen two little pressure gages, one showing the pressure in tank and the other the pressure in the auxiliary chamber. A valve is opened and air is admitted from the pressure tank into the auxiliary chamber, and when the pressure required for the charge is reached the valve is closed and all is ready for the shot. The actual firing is done by the tripping of a quick acting, wide opening valve between the auxiliary chamber and the main barrel. The loading and discharging may be very rapid

FIG 2

MEN LEARNING THE GUN

as long as the supply of air is kept up. There is of course no heating and no erosion to quickly destroy the piece.

NEW YORK CITY THE GREATEST SCHOOL FOR MINING ENGINEERS

An unusually satisfactory bit of work, even from him, was the address of Dr. Rossiter W. Raymond when the American Society of Civil Engineers was formally welcomed to its new home in the Engineering Building. The following is a little taste of it:

The mining engineer is simply an engineer engaged in mining, or connected with some of the arts that are associated with mining. The mining engineer is a civil engineer, plus a mechanical engineer, plus an electrical engineer. He has all the problems that torment those engineers, together with a torturing lot of his own that they don't have.

It is very pleasant to us to have this fact so thoroughly acknowledged as it has been in these latter years. The City of New York, as perhaps you have been told before, has been for the last few years the greatest mining camp on earth. During that period, with its immense system of subways and with its new water-supply from the Catskills and with its deep cellars under its lofty skyscrapers, New York has literally and not figuratively employed more miners and trained more mining engineers than any other mining field on this green globe—and we have made good mining engineers out of civil enginers. I can tell you that there is no such good raw material for a mining engineer as a real, thorough civil enginer. The great engineers that have designed, constructed and conducted the immense public improvements in this municipality within the past 20 years have not only taken up and acquired the art of mining engineering, but they have adorned it with new methods and with new achievements, before which we regular, trained, born mining engineers take off our hats.

At least that is the opinion of the late Professor Christy, dean of the greatest mining school in the country, I think not even second in numbers to our own great school at Columbia. Christy, after making a pilgrimage around the world, stopping at New York on his way, found more new and novel methods of mining in New York City, in our subways and under our pavements, than he had found elsewhere on the whole globe; and he wrote to me that such civil-mining engineers as Barclay Parsons were teachings us a new science of mining engineering. He had been underground where the rock was so rotten that it could not be either held up or bored through, and he found that they were squirting cement into the interstices of this rotten, old gneiss and making an artificial stone of it, much superior to the kind the Almighty had made—that is to say, after nature had had its way in weathering it for a few thousand aeons. They had consolidated this rotten mass until it was made into a splendid new mass of rock, and in that rock had made our subway tunnel with safety.

Not only to pierce the crust of the earth, but to create it in order to pierce it, is a double art, for which we mining enginers here and now desire to thank the society of civil engineers for having invented a new thing in our line.

AIR RECEIVER EXPLOSIONS

By Letson Balliet

The explosion of receivers in compressed air lines and the conduits for compressed air has caused considerable comment in the newspappers. Invariably the non-technical publishers attribute the cause of these explosions to the failure of the safety valve.

While the safety valve is an excellent thing to have upon an air receiver, in case of overpressure and particularly for the moral effect that it has upon the workmen in the vicinity of it, it is well to known that if the air receiv-

er was equipped with a hundred safety valves, all in working order, they would not prevent the explosion if the conditions inside the receiver were right; in fact, the conditions inside the air receiver cause the same result that 50 lb. of dynamite would cause in the same receiver. It must be borne in mind that air receiver explosions are seldom, if ever, caused by excessive pneumatic pressure, but, on the other hand, they are really the explosions of highly combustible oil-gases and vapors pumped into the receiver from the compressor. It is almost impossible to supply lubrication to a compressor in sufficiently small amounts that some oil-gases will not be carried into the receiver and conduits.

Air compressing is the reverse operation of the steam engine. With steam, the pressure is built up in an enclosed boiler, conducted into the cylinders of an engine where it expands, giving off power or energy, and is then exhausted into the atmosphere. The lubricators of a steam engine can safely use almost any amount of oil because it is exhausted into the open air. The air compressor receives its air at atmospheric pressure; power is applied to the pistons for the purpose of compressing it, to be exhausted into an enclosed receiver. Every bit of lubrication fed into the cylinders of an air compressor must eventually pass into the receiver.

It is well to call attention to the fact that the cylinders of an air compressor are not subject to the scouring action that the steam cylinders of an engine are, hence it needs less lubrication in the first place.

Frequently engineers adjust the lubricators for the steam-end and the air-end of the compressor alike, and sometimes when automatic governors control the speed of the compressor the lubricators feed the same amount of oil per minute at slow speed that they feed at high speed.

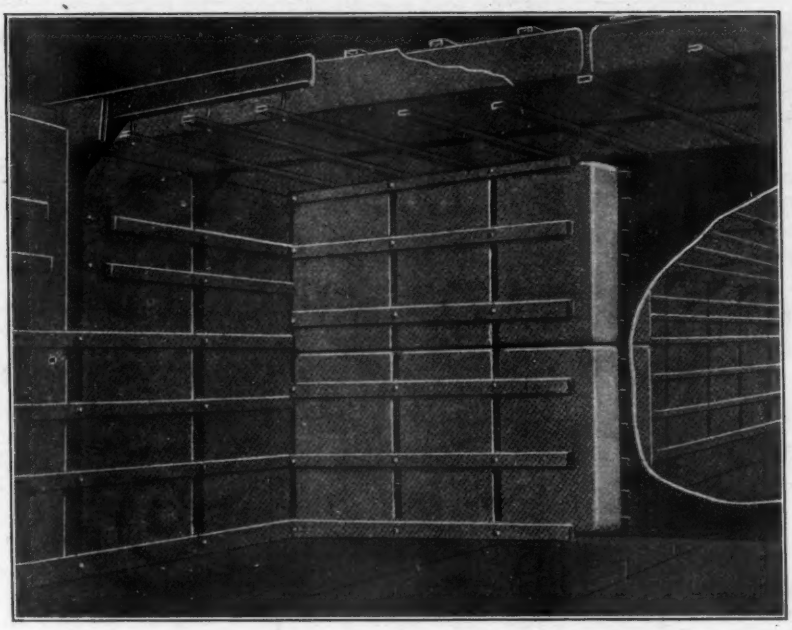
There is, or should be, always an attempt to use lubricating oils that are low in carbon, but no matter what method of lubrication is used it may always be put down as a fact that more or less oil-gas and oil-vapor from lubricating oils is pumped into the air receiver. This is combined with more or less dust gathered from the air, some of which settles in a thick viscous scum upon the inside of the receiver shell, while some of it passes off in gas through the conduits and tools. In fact, I have known men in poorly ventilated mines to be overcome from oil gases that come from the exhaust of rock drills.

The passing of a carbon spark, that may have become ignited with the heat of compression or friction, into the air-receiver might, and probably does, cause the ignition of the oil gas within the receiver, which results in a violent explosion.

Another point which I wish to make in this article is that all lubricating oils used in compressors are marked with a supposed flashing test to indicate the temperature at which the oil will flash, but these tests have all been made at atmospheric pressure, a condition which does not exist in the inside of an air-receiver, nor does the test indicate at what temperature the flash will occur when the lubricating oil has been broken down into a gas.

In line with this thought, I wish to call your attention to the fact that a candle taken down into a caisson, where the operations are conducted under two or three atmospheres, will burn with a much more brilliant flame than the same candle will burn at atmospheric pressure; in other words, the combustion is much more rapid under pressure than at atmospheric pressure, and conversely, a candle taken up to the top of a high mountain will burn with a very sickly, weak flame. This point in combustion is one of the examples cited in our elementary physics, and yet it seems to have been ignored in the study of air receiver explosions due to lubricating oils. Therefore, I am satisfied to say the combustion of lubricating oil and oil-gas must be more violent and rapid under pressure of eight or more atmospheres than at atmospheric pressure, and I am forced to believe that the so-called flash point of liquid lubricating oil at atmospheric pressure is of little value because it does not give the point at which the oil-gas will flash under pressure.

My deductions from the foregoing studies are that the air receiver should be supplied with a manhead and that it should be opened and thoroughly cleaned of the oil and dust that accumulate on the inside of the shell; that it should be frequently drained, and the lubrication of the compressor reduced to the minimum, and it is probably needless to add that the best grades of oil should always be used in the compressor cylinder.—*Power Plant Engineering.*



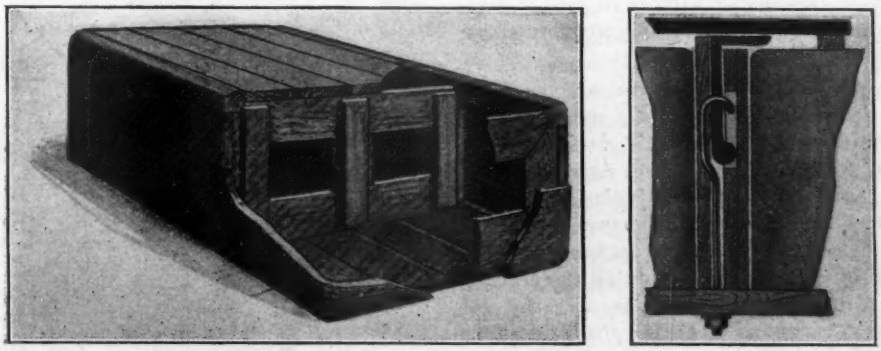
VIEW IN HOLD WITH BUOYANCY BOXES PLACED

MAKING THE SHIP UNSINKABLE

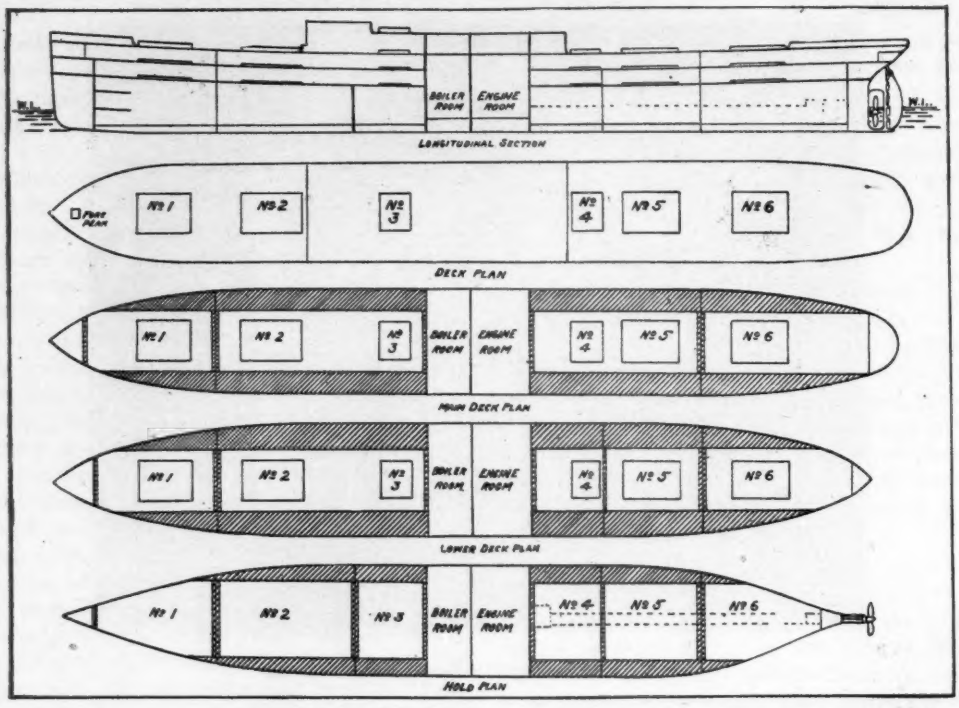
The first officially recognized attempt to render a freightship so far unsinkable that she can take the blow of a torpedo without going to the bottom, is about to be put to a practical test by sending the "Lucia," formerly an Austrian vessel, through the submarine zone. Before very long, this ship will start for Europe with her sides, bulkheads, and the under sides of her decks padded with several thousand wooden water-tight boxes, upon whose buoyancy dependence will be placed for keeping her afloat, even if she should sustain injuries which would inevitably send her to the bottom under normal conditions.

The plans for rendering the "Lucia" unsinkable were worked out by Mr. William T. Donnelly, with the approval of the Naval Consulting Board, and great expectations are entertained as to the success of the venture.

It should be understood, of course, that this scheme of protection is to be regarded as emergency work done on ships afloat—that is to say, it is not proposed to construct new ships along standard lines and then load them with wooden boxes in this fashion. In view



DETAILS OF BOX CONSTRUCTION AND MODE OF FASTENING



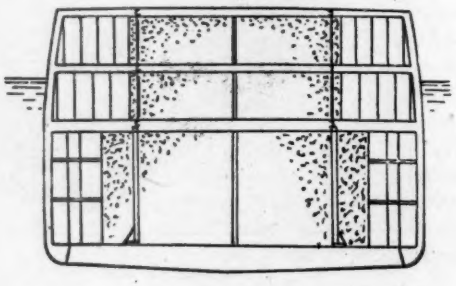
DECK PLANS

of the great lack of tonnage and the urgency for getting our men and their supplies, to say nothing of food for the Allies, across to Europe, any plan which will conserve our shipping and cut down the loss without an undue expenditure of time and money, is entitled to a fair trial. Such, at least, we judge to be the attitude of the Naval Consulting Board in sanctioning this very ambitious experiment.

The "Lucia," which is 432 feet long by 49 feet broad and 38 feet deep, has a maximum deadload capacity of 10,000 tons on her maximum summer draft and of 9,400 tons at her maximum winter draft.

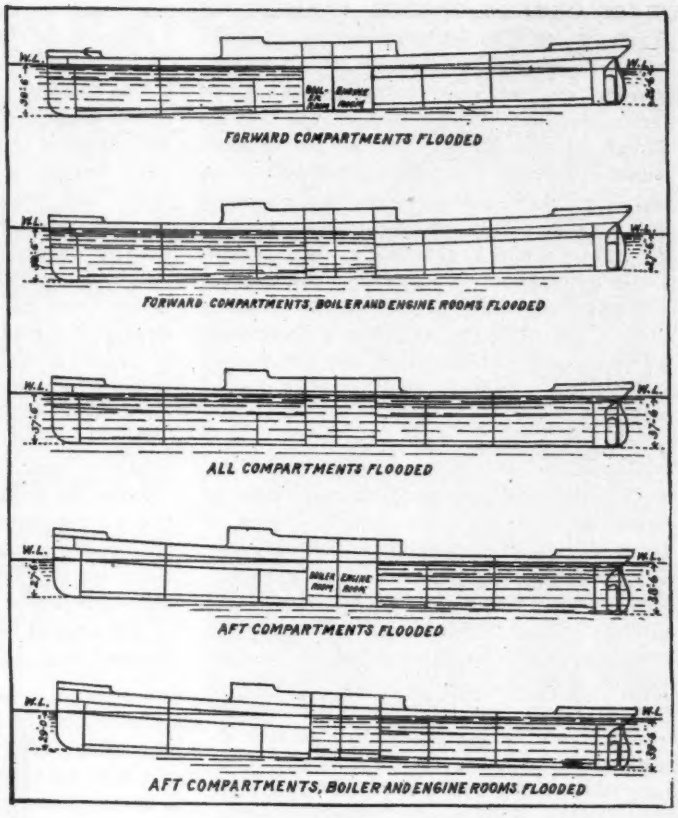
As will be seen from the accompanying line drawings, the ship has six watertight bulkheads, which divide her into five cargo holds, a boiler and engine room compartment, and a collision compartment at the bow. She has three decks, and the system of flotation boxes is applied throughout the full length of the cargo spaces on all three decks. The plans show the ship as arranged for carrying a cargo of coal. The shaded portions in the deck plans represent the extent to which the hull under these conditions, will be filled up with the flotation units. In her normal condition, the "Lucia" can carry 10,000 tons of coal but with the boxes installed she carries 8,300 tons. The total hold capacity of the ship is 508,000 cubic feet when she is provided with a sufficient number of flotation units to protect her against sinking. Of this 152,000 cubic feet will be taken up by the flotation units, and the balance of 356,000 cubic feet at 43 cubic feet per ton will be occupied by the load of 8,300 tons of coal.

The flotation units are made in three sizes—the smallest is 12 inches deep by 25 inches wide and 3 feet, 1¾ inches long; the next is 18 inches deep by 27 inches wide and 5 feet, 9 inches long; the third, and largest, is 30 inches deep by 30 inches wide by 6 feet, 2



MIDSHIP SECTION

inches long. All the boxes are made of ⅞-inch North Carolina pine, and the details of construction are shown clearly in the accompanying sectional perspective view. Two interior transverse bulkheads are provided in each box, and all boxes are covered with galvanized metal to render them watertight. The various units are constructed to withstand pressures corresponding to 10, 20 and 30 feet of water, according to their location in the ship. The method of stowing the boxes is shown in a perspective view of one of the decks. It will be noticed that they are stowed in between the frames of the hull and between the deck beams on the under side of the decks. The boxes are held in their respective positions by means of battens and threaded bolts, the latter being hooked into the frames and deck beams, and the whole system being brought up snugly into position by means of washers and nuts on the outside of the battens.


FORWARD COMPARTMENTS FLOODED
FORWARD COMPARTMENTS, BOILER AND ENGINE ROOMS FLOODED
ALL COMPARTMENTS FLOODED
AFT COMPARTMENTS FLOODED
AFT COMPARTMENTS, BOILER AND ENGINE ROOMS FLOODED

TORPEDOED SHIP IN VARIOUS CONDITIONS

To render a ship unsinkable, three separate conditions are to be considered. First, when she is unloaded; second, when she is loaded with a mixed cargo, and third when she is loaded with a dense, heavy cargo, such as a cargo of coal. For the first condition, reserve buoyancy sufficient to make the ship unsinkable when she is unloaded, is attained by fitting a single layer of flotation units between the frames and deck beams and against the watertight tranverse bulkheads. Cargo reserve buoyancy is determined by the nature of the cargo itself and the cubical area occupied. For instance, in the case of a 5,000-ton ship, 56 cubic feet is allowed per ton, making a total for that ship of about 280,000 cubic feet. The reserve buoyancy units necessary to float the ship when it is unloaded equals about ten per cent. of this tonnage, or 500 tons, leaving a net tonnage of 4,500 tons or 252,000 cubic feet. A coal cargo requires 43 cubic feet of space per ton, which on the net tonnage of 4,500 tons amounts to 193,500 cubic feet. This is deducted from the total net cubic feet and leaves reserve space of 58,500 cubic feet for reserve buoyancy units to float the deadweight cargo. It is claimed by the sponsor for this system that the loss of cargo space in a ship that is self-salvaging is more than offset by the salvaging of the cargo and of the ship itself.

Should this method of protection prove to be successful, it will provide a powerful incentive for the construction in all ships of permanent self-salvaging qualities — something which is sadly lacking in the average merchantship construction of the present day. —*Scientific American.*

GIBBS OXYGEN RESCUE APPARATUS*

It is a complete self-contained unit carried wholly on the back of the user. It is light and its parts are well protected against injury. A special device feeds the oxygen used, and although plenty is available for the wearer when working hard none is wasted when he is resting. Hence the new apparatus may be worn for a considerably longer time without recharging than can models now in use which furnish a constant volume. An unusually efficient carbon-dioxide absorber that liberates little heat is another feature of the apparatus. Caustic soda, which is much cheaper than the potash salt formerly thought necessary, is used as the absorbent.

GENERAL INFORMATION

Normal air contains roughly 20% oxygen mixed with about 80% nitrogen and a trace of carbon dioxide. At each inspiration part of the oxygen breathed combines in the lungs with carbon brought by the blood, and the air expired contains about 4% carbon dioxide. The nitrogen of the air is unchanged by the act of respiration and takes no active part in it other than to dilute the oxygen. The amount of oxygen consumed in the body is precisely the same whether the gas is breathed pure or diluted with nitrogen in the form of air. Contrary to the belief held a few years ago, there is no flushing of the face, no feeling of exhilaration, no increase in the pulse rate, nor elevation of arterial tension.

If, however, the oxygen content of the air breathed be materially reduced, unconsciousness and death are almost sure to follow without any warning symptoms, provided the carbon dioxide content of the air remains low. For this reason it is advisable that breathing apparatus supply an atmosphere rich in oxygen. As much of the oxygen made from liquid air contains 2 or 3% nitrogen, which remains unchanged and accumulates in the apparatus, analyses of the atmosphere breathed by the wearer generally show a decreasing content proportionate to the length of time the apparatus is worn. If the proportion of carbon dioxide in the artificial atmosphere rises much above 2%, deeper breathing or panting warns the wearer of danger, generally in time to let him get to safety.

DESCRIPTION OF GIBBS APPARATUS

The elements that enter into the construction of the Gibbs breathing apparatus are shown in the diagram, Fig. 1. When the wearer inhales through the mouthpiece *A*, the valve *B* opens and oxygen passes from the bag *C* through the cooler *D* to the lungs. On exhalation the oxygen, somewhat diminished in volume and containing about 4% carbon dioxide, issues from the mouth. The valve *B* now closes, but the valve *E* opens to let the mixture of oxygen and carbon dioxide pass into the absorber *F*, where the caustic soda combines with the carbon dioxide to form sodium carbonate with the formation of some water and the liberation of heat.

From the absorber or regenerator the purified oxygen passes by way of the duct *G* to the breathing bag *D*, which expands to make room for it. The total volume of gas in the apparatus is now less than the original volume by the amount of carbon dioxide taken up by the absorbing can. After the wearer of the ap-

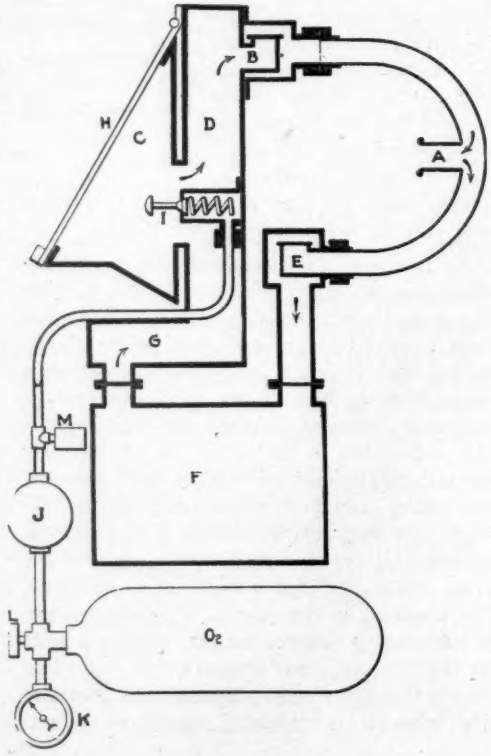


FIG. 1

*This apparatus, in several respects superior to other types, has been developed by Mr. W. E. Gibbs, engineer of mine-safety investigations, in cooperation with other members of the staff of the U. S. Bureau of Mines.

paratus has taken a few breaths, the bag *C* collapses enough to permit the weighted lever *H* to open the oxygen-admission valve *I*, when the bag *C* fills again automatically. The heat generated in the absorber is removed from the gas by radiation, partly from the cooler *D* and partly from the bag *C* and the connecting tubes. A reducing valve *J* lowers the pressure of the oxygen from about 2000 lb. per sq. in. in the bottle to a pressure that may be controlled by the admission valve *I*. A pressure gage *K* indicates the available oxygen. The gas may be turned off by the stop valve *L* when the apparatus is not in use. A relief valve *M* operates when the pressure in the circulatory system becomes too high. In order to be practicable, breathing apparatus should be mounted on a suitable frame and be conveniently supported on the user.

A magnalium casing contains the valve-closing toggles, which are actuated by a flexible metallic bellows. Except for a rubber gasket at the junction of the casing and the toggles, all the parts are of metal. When this reducing valve is attached to a cylinder of gas at a pressure of 150 atmospheres, the pressure inside the bellows, with the outlet closed, is about one-sixth of an atmosphere. This remains constant even after the outlet has been shut several hours. Such a reducing valve makes it possible to admit oxygen intermittently to the breathing bag in the exact quantity required by the user under conditions varying from complete rest to extreme labor. All parts of the breathing apparatus are mounted on a frame of steel tubing which is carried on the back. The illustration shows the apparatus in use with its protecting cover of aluminum removed.

The absorbing can *F* has been the subject of much experiment. A form tentatively adopted contained 20 vertical sheets of fine iron-wire gauze, held parallel to each other and one-fifth of an inch apart by spacers. These sheets before being put in the can were dipped in molten caustic soda containing 20% water. The caustic solidfied on the gauze when cold, forming reinforced plates about 1-16 in. thick, between which the expired air passed. The plates not only absorb carbon dioxide from the wearer's breath but maintain a uniform surface from which the condensed and chemically produced moisture drains away, so that the capacity of the absorber is nearly constant until the active material has all been used. Recently another type of absorber, containing caustic soda in lumps, has been adopted.

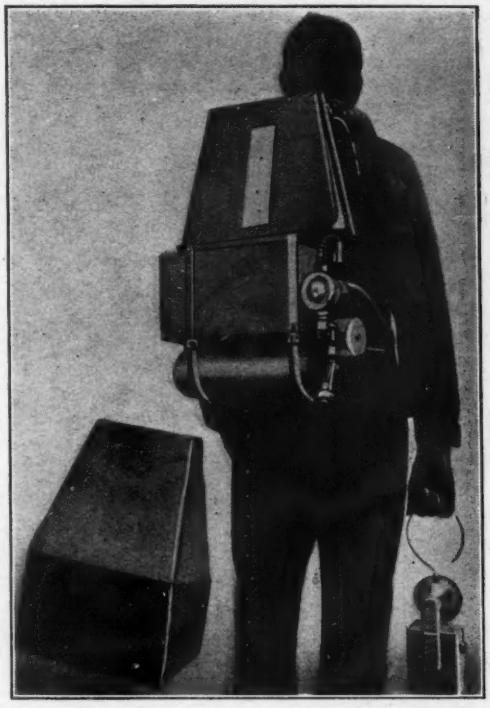


FIG. 2

A pressure gage or "finimeter," which is read by touch, instead of sight, and sounds an alarm when the oxygen in the cylinder has been reduced to 30 atmospheres, completes the apparatus. The whole device, which weighs only 30 lb., or considerably less than other types, is suspended from the shoulders by leather straps. There is a minimum of parts. All the connections have been made without the use of rubber wherever possible. A simple mouthpiece and nose clip is used instead of a helmet. Experience has shown that the helmet is dangerous, and its use has been abandoned by the Bureau of Mines. The pressure within the apparatus is maintained slightly above that of the atmosphere by the pressure of a weighted flap *H* on the breathing bag. Consequently, if the apparatus is punctured, or if a crevice in any part of the system opens, the leakage is outward only. Exhaustive tests of the new apparatus have shown that it permits unusually free breathing; that the air supplied is comfortably cool; that as the front of the body of the wearer is entirely free he is not hampered in his movements; and that the parts of the device are well protected against accident.

COMPRESSED AIR FOR CLEANING MOTORS

By D. R. Shearer

In a great many manufacturing plants, especially those working in wood or a similar material, the driving motors have a tendency to become clogged with dust in a short time. Such accumulation of dust is a fire hazard, particularly if the motors are overloaded and liable to have coils burn out; and if a motor is not overloaded, it may heat if the air ducts are filled with dust. Moreover, the motor is not able to carry the peaks when called upon, for the reason that the additional heat cannot be dissipated. Motors should be cleaned frequently, but such cleaning with the means ordinarily at hand is a rather difficult procedure since the air ducts are usually small and difficult to clear with a brush. The windows may be brushed off externally, but such cleaning does not reach the real seat of the trouble.

One of the best methods is compressed air under considerable pressure. If the air is not available from some source already in use, it is advantageous to use a small motor-driven compressor and a storage tank. The compressor should have a capacity of from 4 to 10 cu. ft. of air per minute at a pressure of 100 lb. per sq. in., and the tank should hold from 40 to 100 cu. ft. This size will take care of the average plant.

In piping a factory the air line can be 1-in., ¾-in and ½-in. pipe. Since the amount of air used in cleaning any one motor is small, a large pipe is not necessary. An outlet with a valve should be placed near each motor, or if they are grouped, several motors can be reached from one outlet with ½- or ⅜-in. hose; the smaller size is more easily handled. The nozzles can be made up of brass rod of suitable sizes and shapes, one of which is shown in the illustration. It is necessary, however, to use nozzles with small openings as a large nozzle opening would consume too much air. Probably the most useful sizes would be 3-32, 1-16 and 3-64 inch, and these three nozzles will meet most conditions.

Sometimes it becomes desirable to clean surfaces with air; for instance, the walls or ceilings of the buildings. This may be done with a tool made from ⅜- or ½-in. pipe in which there are a number of holes, as shown, to form a "brush" of escaping air. For ordinary purposes holes of about 1-32 to 1-64 in. can be used.

These small nozzles do not clog readily if all the scale and dirt is blown out of the piping. As an investment such a cleaning system will be found to pay for itself in the reduction of motor troubles and the decrease in fire hazard.—*Power.*

SHARPENING AND DISTRIBUTING MINE DRILL STEEL

By Howison Crouch

The present system of distributing drill-steel at the Empire mine, Grass Valley, California, has been in use 20 months, and the results have been so favorable as to warrant a brief description. It was developed to overcome the weakness of the old method, which became apparent when the milling capacity was increased and greater tonnage demanded.

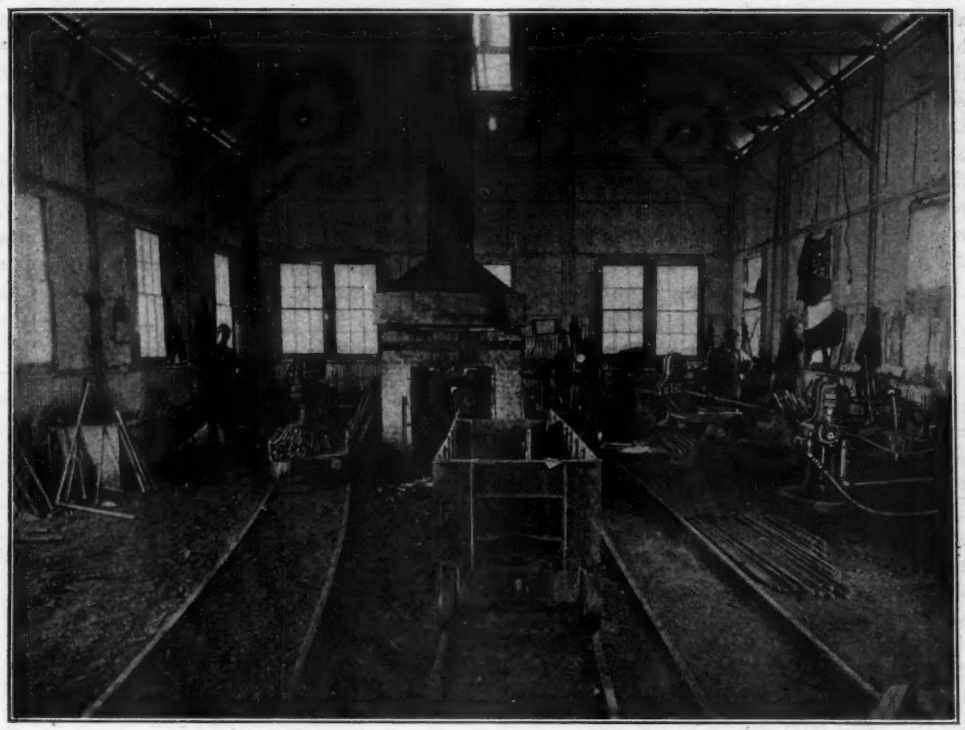
THE OLD SYSTEM.

Under the old system, sharp steel was sent down in the morning for the use of the day shift, and the steel that had been dulled on the previous night shift was brought up. Part of this dull steel would be sharpened and sent down again in the afternoon for the use of the night shift. In spite of this apparently active circulation, the miner was often kept waiting for steel. If he was not lacking in the number of drills he was likely to be short of the desired lengths.

THE NEW SYSTEM

Under the new system enough steel is provided for two full shifts in each stope. The sharp steel is delivered to each level but once a day, this being the last thing done before the night-shift men are hoisted, and is part of the duty of the skip-tender and helper.

The steel is handled on two trucks specially made for the purpose, with compartments for keeping the allotments for the various levels separate. The dull steel from the previous two shifts is on the stations and is picked up the same trip. Gates are provided at the collar of the incline shaft, and the trucks, loaded with dull steel, are run direct to the tool sharpener's shop, where it is sorted and counted. After sharpening and tempering, it is replaced on the truck according to a tag, which will be mentioned later, sent from underground by the tool-boy. Any shortage due to breakage, or any extras demanded, are provided from the



DRILL SHOP, EMPIRE MINE, GRASS VALLEY, CALIFORNIA

stock-pile, which is supposed to be kept adequate for all emergencies.

THE DRILL RECORDS

Each tool-boy is provided with a book, conveniently ruled and furnished with carbon, in which, as he visits a stope on any particular level, he records the number and the lengths of the dull drills taken out. After he has visited all the stopes on a level, he tears off a tag from his book, which is given to the mule-driver on that level, showing the number and lengths of sharp steel to be delivered from the supply at the stations to the steel-racks provided at the manways, leading to the stopes. The rest of the leaf of the tool-boy's book is sent to the shop, and shows the number and lengths of sharp steel to be put on the truck in the proper compartment for that level. The broken steel is also recorded and a similar piece substituted when the truck is loaded.

The theoretical result is that each stope is always provided with enough drills of the right kind. Each level and stope gets back on the next truck the same number and kind of sharp drills that were taken away dulled on the previous day, including the broken steel. The actual result approaches this condition quite closely, considering that four different sets of men handle the business; also due allowance must be made for carelessness and indifference. The six levels from 3000 to 5000 ft. inclusive are visited by two tool-boys, who collect and record the dull steel from the working-places. The ore-bodies are, in most cases, at a considerable distance from the shaft; consequently the steel must be transported on each level for distances varying from 1000 to 4000 ft., and must be collected from and distributed to three to twelve working-places.

SLIDES FOR THE STEELS

The pitch of the vein is about 40°, and, therefore, to facilitate the handling of the dull steel in the stopes, slides have been placed in the manways, through which the steel is delivered to the level below, proper precautions being taken, of course, to avoid accidents. A detailed count of all steel underground and in the shops is made once every three months. The total number of pieces has remained nearly constant, refuting the objection that if an

abundance of steel were furnished, there would be a high percentage of loss. The number of the longer lengths decreases, due to breakages, while the number of short drills increases. The short lengths recorded as being rejected because too short for use, correspond closely to the number of pieces of new steel cut. The record of broken drills seems to show that, when there is a shortage of drills in a stope, the percentage of breakage increases.

THE DRILLS IN THE MINE

Hammer stopers, using solid steel and a cross-bit, are used in the stopes, while the driving is done with water-machines using hollow steel with a cross-bit. There is a considerable variation in the character of the ground drilled, both in the drifts and stopes. The foot and hanging walls, in the lower levels, are granodiorite, and in many cases the fissure is not wide enough to afford suitable working space, and the drilling must be done in one or the other wall. Sudden increases in the hardness of the ground, especially in the drift, sometimes causes a heavy demand for drills, but if the stock-pile has not been neglected, the emergency is readily met.

TOOL SHARPENING EQUIPMENT

The tool-shop equipment consists of two No. 5 and one No. 3 Ingersoll-Rand pneumatic sharpeners, and one pneumatic punch of the same make, for clearing the holes in the hollow steel. Concrete tanks, with screens near the bottom, are used for tempering. Crude oil is used for fuel in the furnace, which is of the ordinary type, enclosed with a substantial brick wall, having openings on three sides, and provided with a hood and large flue for carrying off the waste heat. The structure itself is built of steel, no wood whatever entering into its construction. Worn T-rails were used for the frame and rafters, to which the roof and sides of corrugated iron are riveted. The dimensions of the building are 45 by 30 ft. with eaves 15 ft. high, giving plenty of air-space, and producing the maximum of comfort for the men. The work of the shop is done by three operators and two helpers, working eight hours per day.

A daily record is kept of the work done, including new steel cut, and while the amount varies somewhat at different periods, on account of fluctuating demand for drills, it will be fairly well represented by the three months of June, July and August, 1917. During this period, in which there were 79 working days, a total of 51,029 pieces of steel were handled, or an average of 645.9 pieces per day. An itemized statement of costs follows:

COST PER PIECE

	Cents
Labor	2.56
Crude oil	0.24
Compressed air	0.24
Furnace repairs	0.03
Sharpener repairs	0.01
Miscellaneous	0.01
Total	3.09

—*Mining Press*, San Francisco.

AIR OPERATED FIRE DOORS FOR LOCOMOTIVES

The use of pneumatic fire doors bids fair to become universal on steam locomotives. On locomotives of the heavier types not equipped with mechanical stokers they are a real necessity. Several very successful devices have already been perfected, and among these the Franklin Automatic Fire Door to which attention is here directed.

The essential features comprise a door frame, door plates, operating cylinder and a pedal which controls the movements. On what is called the "Butterfly" arrangement, here shown, the door plates are mounted on hardened steel pivots and work together through heavy gear teeth, one of the plates, or half-doors, being connected to the operating piston by a link. The door is opened by a movement of the piston, the power being compressed air admitted to the cylinder on which the piston is enclosed. When the piston reaches the maximum travel the door is fully open. Baffle plates are fitted to the door plates, and protect the door plates from the intense heat of the firebox. They also serve to heat the air that passes through the openings in the door plates. This not only aids combustion, but helps to maintain a more uniform fire-box temperature.

In Fig. 1 the hand lever will be noticed which is used for operating the doors when there is no air pressure, this lever having no

*Condensed from *Railway and Locomotive Engineering.*

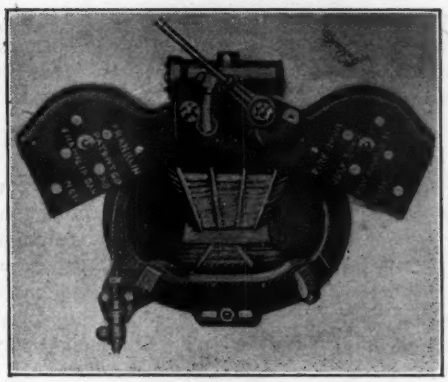


FIG. 1

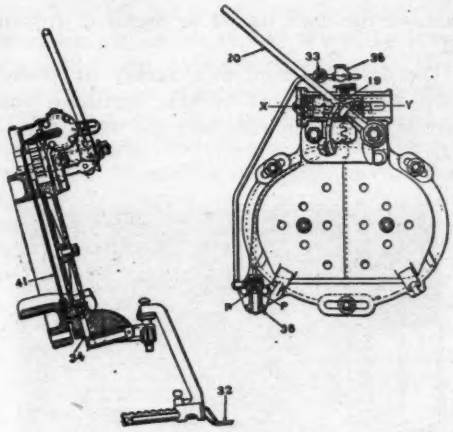


FIG. 2

motion when the air is used. In operation the air is admitted through a strainer valve and an adjustable valve into the operating valve. When the foot of the operator is placed on the tread a valve is opened at the lower part of the door, being raised from its seat, allowing the air pressure to pass through a pipe which connects the valve to the cylinder head. The enclosed piston is carried forward by the action of this air pressure, and transmits its movement to the doors through a link which is attached to the left hand door plate.

As the piston moves forward the door plates are rotated around the fulcrum pins until they have uncovered the opening in the door frame. In this position the link is centered, and it is impossible for the piston to travel any further. Should the momentum of the door plates be such as to carry the doors beyond the full opening position the piston would be pulled back against the air pressure in the cylinder. This would act as a cushion and bring the doors to a stop without jar or noise.

When the foot of the operator is removed from tread the valve closes, cutting off air pressure to the cylinder, at the same time permitting the air in the cylinder to exhaust to the atmosphere through an exhaust port in the valve body. The weight of the doors causes them to close, at the same time returning the piston to the left end of the cylinder. In closing the door is cushioned, and as the doors close rapidly there is sufficient pressure remaining in the cylinder, the exhaust being restricted, to slow up the movement of the doors and allow the plates to come together without slamming.

A latch having two notches to engage the hand lever is also provided. The first notch, which is known as the smoke notch, holds the door open about eight inches at the bottom to allow the admission of air to the fire-box, while the locomotive is standing at stations. The bottom notch is located so as to hold the doors in the full open position. The supply of air for operating the door should be taken from the main reservoir pressure.

In operation, the door should be opened and closed after each scoop of coal by means of the pedal, and from carefully collected data there is an average of 585 distinct movements on the part of the fireman for each ton of coal consumed on locomotives not equipped with pneumatic fire doors. This number of movements is reduced to an average of 234 by the use of the door described. On some long freight runs, where twenty tons of coal may be consumed, the relief to the fireman is very great.

The lessening of the labor of the fireman is not the only gain. The ready opening and closing of the door after each scoop excludes as much air as possible from the firebox, thus preventing the expansion and contraction of the tubes, keeping up the temperature of the firebox and insuring the air being drawn through the grates so as to furnish necessary air for combustion.

Extensive tests have also shown that in the amount of coal used on engines equipped and not equipped with the pneumatic fire doors the difference is considerable.

The care of the door involves little labor. An oil cup is provided on the top of the cylinder, and the fulcrum pins are oiled through oil holes on the front of the cylinder. All other

parts of the door should be operated without oil.

The device is used in a variety of forms, some with the doors opening vertically, one portion moving upward and the other downward.

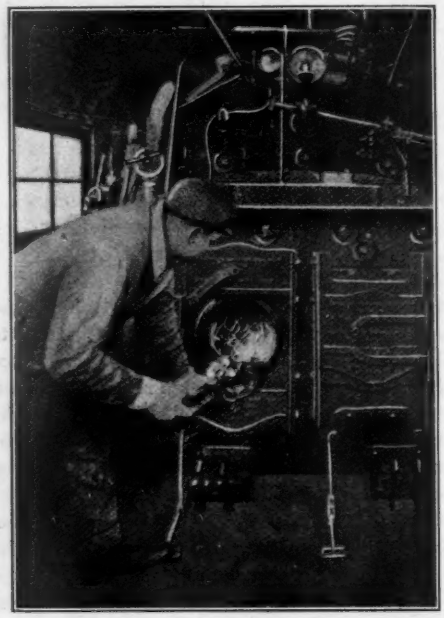


FIG. 3. VERTICAL SLIDING DOORS

DANGER OF OXYGEN RESCUE APPARATUS*

When oxygen rescue apparatus was first introduced in the United States and made use of in the mines following explosions and fires, there was a wide misconception on the part of many miners and mining men as to the extent to which it might be used, and the limitations of the physical endurance of those who volunteered to wear the apparatus. Many conceive the idea that with an oxygen apparatus a man immediately acquires superhuman strength and endurance. It is not putting it too strongly to state that a number of good men have gone to their death in an effort to satify a false belief on the part of spectators that the apparatus had no limitations, and that the wearer knew no limit of physical exertion.

The helmet type of apparatus has received condemnation by many scientific investigators, and the Bureau of Mines has publicly denounced its use for mine or fire-fighting purposes; still there are some who persist in its use, and they are but challenging death. Some helmets may be made to fit tightly temporarily, but the models now in use have large dead spaces, and under enforced breathing admit external air.

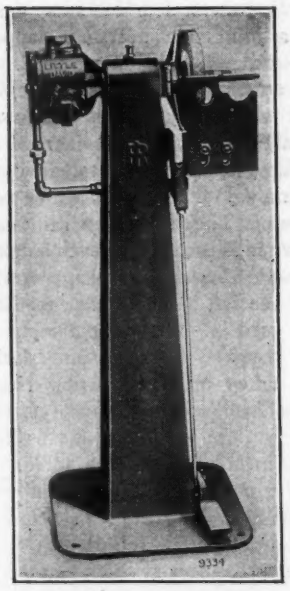
It is safe to say that a number of deaths here and in foreign countries have resulted through the wearer breathing his own carbon dioxide, or through leakage of external air into the circulating system of the apparatus. To overcome the re-breathing of air highly charged with carbon dioxide, an efficient absorber is one of the essentials; the apparatus, if of a constant-feed model, should supply an excess of oxygen above the requirements of the wearer; if an intermittent feed, there should be either a constant leakage externally or an auxiliary supply held within a flexible medium under small pressure, which will make the breathing circuit under positive pressure.

The difficulty experienced by designers and manufacturers heretofore has been that the physiological requirements have not been given full consideration. The apparatus has been constructed in a manner which enables the wearer to perform limited physical work. However, it is a source of gratification to report that some manufacturers are now enlarging the absorbers and providing a bypass valve and readjusting the zone of reduced, or negative, pressure.

The Gibbs apparatus, described in U. S. Bureau of Mines technical paper No. 82, is constructed with the sole idea of adapting the apparatus to the limitations of the wearer, whereas some types now in use require the man to adapt his activities to the limitations of the apparatus. This subject has been discussed in a technical paper issued by the Bureau of Mines under the Joint authorship of Dr. Yandall Henderson and James W. Paul, the subject of which deals with the status of oxygen-rescue apparatus and the physiological effect on users of such equipment.

---

*Abstract of an article, "Status of Oxygen Rescue Apparatus and Physiological Effects on Users," by James W. Paul, chief of coal-mining investigations, U. S. Bureau of Mines, Pittsburgh, Penn.; presented at the meeting of the National Safety Council, New York, Sept. 13, 1917.



AN AIR DRIVEN PEDESTAL EMERY GRINDER

For general service in machine shops and elsewhere, where a stationary pneumatic grinder is more suitable than a portable tool the Ingersoll-Rand Company, 11 Broadway, New York City, is placing on the market the machine here shown, the No. 8 "Little David" grinder. The three cylinder motor, with its continuous power impulse, the rotary valve intyral with the crank shaft, and the triple ball bearing spindle are of design similar to the No. 7 grinder. The machine is rated to run at 3400 r.p.m with air at 80 lb. The foot lever provides complete control. The wheel normally employed is 8 in. diameter and 1 in. face.

PRECISE PAYMENTS FOR ACTUAL WORK DONE

Figures for 1917 covering the earnings of molders, molding machine operators, cleaners and other piecework employes, that are being compiled by foundrymen for the information of income tax collectors, reveal surprising totals. In some plants machine operators have received nearly $5000 in wages, and $2500 and $3000 for the year's efforts are commonplace figures that were attained last year by thousands of workers in casting plants. Few crafts are paid so well and not many vocations hold out the inducement for maximum effort and application as that offered by foundry employment on a piecework basis. It is an unwritten law in piecework shops that when a price once is set it is never changed, and in appreciation of this, records of production are made and broken by new high marks that never were believed to be possible of accomplishment. Nor have these increased wages been without compensation for the employer. Production is increased without unnecessary addition to the equipment, thereby reducing the overhead and other fixed expenses. Furthermore, this has relieved the labor situation in many of these shops, and the reputation for high wages is an attraction for the employes of other plants that impels their gravitation to these foundries. The introduction of piecework in the patternshop, always considered impossible of achievement, has been tried out successfully in one large plant. Not only are the patternmakers earning from $40 to $110 per week, but the number of employes has been reduced from an average of 90-odd to less than 50. The setting of prices for patterns is more difficult than for castings, and the employment of a skilled man for this work is essential. Wherever a fair rate has been set for cleaning and chipping castings, the earnings of the workers have been doubled and trebled and the output of the plant has been increased proportionately. Piecework as a war measure certainly has speeded-up production and increased output.—*The Foundry.*

DRY-AIR BLAST FOR HARDENING ICE CREAM

The hardening of ice cream is said to be one of the severest tests to which refrigeration is put to-day, the object being to extract a given number of heat units from each gallon of ice cream in the shortest possible time after it comes from the freezer, changing it from semi-solid to solid form. This was formerly done by means of ice and salt, and with the development of mechanical refrigeration the cans were submerged in cold brine. Considerable interest now attaches to the dry-air blast system of hardening ice cream, in view of the need for conserving ammonia and energy in mechanical refrigeration of all kinds.

The dry-blast idea is embodied in a system by which the cold air is blown around the cans by a power fan. Where there has been

any failure of this system it has been nearly always traced to the rapid formation of frost on bunker coils, and success has depended upon stopping up leaks of air into the cooling room and providing good insulation. Air leakage is often unsuspected, and close examination of the plant for defects is recommended, with care in not using unsuitable buildings for dry-blast purposes.

CANVAS TUBING FOR MINE VENTILATION*

Metal tubing, with blower or exhaust fans, has long been used to supply air to dead ends where natural ventilation is impossible, and in driving smoke from such places. In Butte, Mont., canvas tubing has been used extensively and has many advantages not possessed by metal tubing. Improvements in the canvas itself, the jointing of sections and manner of suspension have increased its usefulness. A product now on the market is impervious to air, fireproof, and provides a system of jointing that permits the tubing to be put up or taken down in a few seconds.

CANVAS PIPE AS USED AT GRANITE MOUNTAIN SHAFT PREFERRED TO GALVANIZED TUBING

Deepening the Granite Mountain shaft of the North Butte Mining Co., Butte, Mont., from the 3100- to the 3700-ft. level was begun in 1916. Satisfactory progress was made for a few months, but air conditions became poorer with depth, and the best workmen left. The Granite Mountain is a downcast shaft with a good supply of air on the 3000-ft. level. A fan with galvanized tubing extending from the 3000-ft. level down the shaft, through the pump compartment, had been considered. But the drawbacks and disadvantages of the galvanized tubing were such that the engineers in charge decided to try a canvas tubing that was placed on the market about the time that the work on the shaft was begun. No means of joining sections were attached to the tubing and connections were made by slipping two ends over a wide metal hoop and holding the canvas in place by wiring it there. When two lengths were joinend in this way, a comparatively slight weight could pull the sections apart. Probably concussions have worked the same result.

*From Paper by L. D. Frink, Feb. Meeting A. I. M. E.

RING JOINTS AND TENSION BANDS

Later a joint that not only supported the canvas, but a greater load, was used. This was made by attaching two rings of the same size, either of which may be put within the other by contracting one ring; it is reversible and can be taken apart or put together while the fan is running. The canvas which covers the fan is running. The canvas which covers the ring, being sewn in at each end of each length, acts as a gasket and prevents air leakage. In drifts and crosscuts, tension bands similar to the suspension ring used in shaft work are put over the joints at required intervals and slack in the tubing is taken up. Supporting rings, made from galvanized iron, were put over the joints and hung in the shaft by means of wires. After the installation of the tubing and the start of the fan, the best shaftmen were back looking for a place in the shaft, showing that working conditions had improved.

SHAFT PROGRESS MORE THAN DOUBLED WITH FLEXIBLE-PIPE INSTALLATION

August, 1916, progress amounted to 132 ft. against 50 ft. in July and 60 ft. in June, and the 20-ft. sump below the 3700-ft. level was cut in a few days in September. By using pieces of varied length, the tubing was kept as close to the bottom as the shaftmen wished it to be. In adding lengths the lowest, or blasting piece, was always removed and a new length placed above it. No great difficulties were encountered in the use of the tubing in the shaft. Occasionally the supports had to be lowered because of the stretching of the canvas; a few holes where the tubing was cut by flying rocks had to be sewed up, and it was necessary to start the fan after it had been stopped to hang the lines for timbering. Velocities of the air taken at the discharge averaged over 5000 ft. a minute. Rock temperatures in drill holes on the stations at the 3600- and 3700-ft. levels ranged between 100° and 105° F. A No. 4 Sirocco fan blowing through a 16-in. tubing was used, but this was larger than necessary.

TUBING USED IN CROSSCUT WITH BREAST 2100 FT. FROM AIR SUPPLY

The success in the ventilation of the shaft prompted the management to put a fan and some tubing in a crosscut being driven from the shaft. Conditions here were different, as water temperatures taken near the breast gave 65° F. While this is satisfactory as a working temperature, the accumulation of powder gas

at the breast made it impossible to keep a full shift working, and rounds were repeatedly lost, so that the problem was not to cool the place but to clear it of smoke. The breast was 2100 ft. from the nearest supply of air—an upcast raise with a temperature higher than that of the breast of the crosscut. A fan house was put up over this raise, and 16-in. tubing extended in 1500 ft. to a booster fan. From this point the air was sent through another tubing to the breast. The joints between sections were the same here as in the shaft, but the method of support was different. A messenger or suspension wire (No. 8 galvanized) was

WATER CONDENSATION IN TUBE REQUIRES ATTENTION

The next morning it was found that each low place in the tubing was weighted with water, caused by the condensation of the air in cooling. Conditions at the breast of the drift, however, were much better than they had been, and the shift could easily work there. The sections were then disjointed and the water was drawn off. It was evident that the condensation could not be prevented, but by placing grommets in the bottom at both ends of each section, and keeping these corked, air leakage would be stopped, and by shutting down the

CANVAS TUBING NORTH BUTTE MINING COMPANY

stretched, the ends being fastened to stulls in the crosscut. At points from 25 to 40 ft. apart sprags were put up, and the wire was stapled to them to prevent sag. In the hem of the tubing, two grommets or eyes were inserted at three- or four-ft. intervals, and in these were fastened wire clips or hangers. By means of these hangers, the tubing was rapidly hung to the messenger and made fast by bending the hangers together. Between the sections a tension band similar to the suspension ring used in the shaft was placed over the joints, and when the slack was taken up it was wired to a clamp that held the messenger wire and prevented the tubing from drawing back. The fan delivered, when running, about 2500 cu. ft. per min. at the end of the line.

fan for a few minutes each morning the ditch man could run all the water to the ends, pull the corks, tie up a short section and move on to the next joint to do the same. By the time the last sections were drained, he could start back along the line untying the canvas and replacing the corks. All would then be well for another 24 hours. Later the booster fan was not necessary, and the tubing was connected straight through, making, before the crosscut was finished, a 2400-ft. line. Conditions at the breast of this crosscut could not be made entirely satisfactory, because of the poor supply of air that had to be used, but the place was put in such condition that a round was seldom lost and the men remained, with but few changes, until the crosscut was complete.

When holed through to the Rainbow shaft, the crosscut was a mile from the Granite Mountain shaft, the source of the air supply.

This was the first ventilating air line that had been run in a crosscut, and the tubing conformed easily to the bends. Where galvanized pipe would have been hard to install, because of jutting rock or slight bends, the canvas passed them in smooth curves. Elbows to fit any angle were easily made by cutting the tubing to pattern, as a tinsmith cuts elbows, and sewing the two ends together.

REMOVAL OF BLASTING PIECE PREVENTS INJURY TO PIPE DURING BLASTING

In this crosscut some difficulty was experienced with the leading lengths until a successful blasting piece was made. This piece was made up with harness snaps fastened to ears sewed to the hem of the tubing, so that it might easily be put up or taken down. Before spitting a round of holes, this piece was detached and carried back to a safe place. This would leave the discharge far enough removed from the breast to be safe from flying rocks and the effects of concussion, and still close enough so that the smoke would quickly be driven out. When the next shift came on they would replace the blasting piece so that the air might blow directly on the workmen.

On the 3,000-ft. level good air was supplied to the breast of a drift by means of a No. 2½ Sirocco fan blowing through 500 ft. of 10-in. tubing. In this length there was one place where the water ran on the tubing in streams, but the canvas showed no ill effects from the bath. The cost per foot of driving was reduced about 50% in this drift, and no difficulty was experienced in keeping men. On the 3200-, 3400-, and 3600-ft. levels, considerable use has been made of the canvass tubing in the crosscuts. Rock temperatures on these levels are high, being 100° F. at the 3200-, 102° on the 3400-, and 104° on the 3600-ft. level, but as yet a separate fan has not been put on each of these levels, and all the air is supplied by a No. 6 Sirocco fan blowing from the 3000- ft. level. An air box has been put in one corner of the pump compartment of the shaft. At each level, the box is tapped and direct connection is made to the flexible tubing that runs to the breast of the crosscut. In spite of the high rock temperatures, the working conditions at the breast have been comfortable, and by having in each working place a number of short lengths, the men can bring the lead piece as close to them as they wish. When the short lengths are all in use, a long length is sent down to take their place. This order of changes is repeated as the work progresses.

TUBING IN RAISES BOXED FOR PROTECTION

Ten- and 12-in. tubing is used on these levels. By its use, it is found that the tension rings, used in connection with the clamp that grips the wire, and of course the clamp too, are not necessary on the smaller tubing. When they are not used, the clips that are bent around the wire messenger to support the tubing must be carefully tightened. More care must be exerted in the use of the canvas tubing for ventilating raises than in crosscuts or drifts. With high rock temperatures, it will be found that added advance and the consequently diminished cost will repay amply the time spent in placing and protecting the tubing. In all the vertical parts of the raises, it is found necessary to box the tubing for protection from falling rocks. These boxes need not be air-tight and can quickly be thrown together out of 1-in. material. At the offsets the tubing need not be covered. The discharge from the top box must be covered with a screen to keep falling pieces from going down the tubing, and it must be especially well protected when blasting.

SUFFICIENT VENTILATION NOT ASSURED BY PROXIMITY TO AIR SUPPLY

The proximity of a current of good air does not necessarily mean a good place to work. A stope was started on the 2600-ft. level directly over a crosscut used as a main air course of the level. On the first floor the conditions were good; on the second floor the stope was a poor one to work in, and the third floor was so hot that little was accomplished, though neither end of the stope was 50 ft. from the main air course, but no natural ventilation was obtainable. A No. 4 Sirocco fan with a 20-hp. motor was placed at the crosscut and the air was taken through a 16-in. tube up a manway and turned directly on the men in the stope, which made it a good place to work. Stopes such as this must often be worked until connections can be made to other levels, and the use of blower fans seems to be the best solution of the problem pre-

sented by such places. In one stope with ample connections between levels a No. 4 fan and 16-in. tubing completely reversed air currents, with a resulting drop of 15 degrees. This result was accomplished without causing any apparent ill effects in the other workings. Often places are encountered in both stoping and development where artificial ventilation is needed only while a raise is being put up, or a cross-cut or a drift extended. Such work may take a month or less. Normal conditions may be such that it is impossible for men to work in these places. The short period of time necessary to have the fan blowing before natural ventilation can be obtained does not warrant the building of a concrete foundation. Wood foundations have been eliminated almost entirely for all electrical machinery on account of fire risk. As motor haulage with direct current is used almost entirely, and the trolley lines reach almost every part of the mine, some No. 2 and No. 3 direct current fans, placed on heavy plates, have been mounted on trucks and so arranged that they may be turned to any horizontal angle with the trucks, and makes satisfactory installation for use in these places.

The experience of the North Butte Mining Co. with canvas tubing has extended over a period of more than a year and has been tried out in all sorts of working places, and in every case has justified the installation. Canvas tubing is more satisfactory than metal tubing, and those who adopt its use are not likely to return to galvanized iron.

THE GARAGE DANGER

Notwithstanding all warnings against running a gasoline motor in a closed garage many deaths by suffocation are reported every year when cold weather comes on, and they are usually of people who are supposed to be reasonably intelligent. For the benefit of automobile users we will repeat the warning not to run an internal combustion motor in a closed garage under any circumstances. Contrary to the general impressions the gas that produces such sudden and fatal results, has no odor whatever, and a surprisingly small percentage of the gas is fatal. Moreover, in most cases, the gas gives absolutely no warning of its presence and the victim has no chance, the first sign of its presence being a sudden, total and helpless collapse.—*Scientific American.*

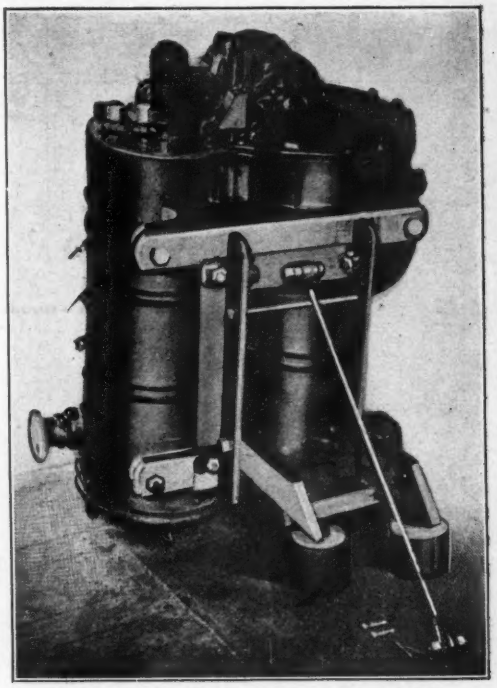


FIG. I. COMPRESSOR BOLTED TO TABLE

AIR BRAKE COMPRESSOR REPAIR TABLE

A particularly substantial and useful table for the rigid support of air compressors of all sizes while under repair has been designed by F. P. Brotherton and J. H. Hahn and is being used with good results in the Norfolk & Western shops at Bluefield, W. Va. The following description was written by Mr. Hahn for the Railway Mechanical Engineer.

This device is made up, as shown in the illustrations, of a hinged table mounted on the upper end of a piston rod, the piston and cylinder of which are beneath the floor. A movable arm, connected at one end to the floor and at the other end to the free side of the table, causes it to change from a vertical to a horizontal position when the piston rises.

In operation the compressor is up-ended and bolted to the table as shown in Fig. 1, the air being released from the cylinder. When it is desired to raise the compressor, the air is turned on and the piston begins to rise. This lifts the lower end of the table, but the upper end is restrained by the movable arm so that it gradually tips until with the piston in its extreme upper position, the table and compres-

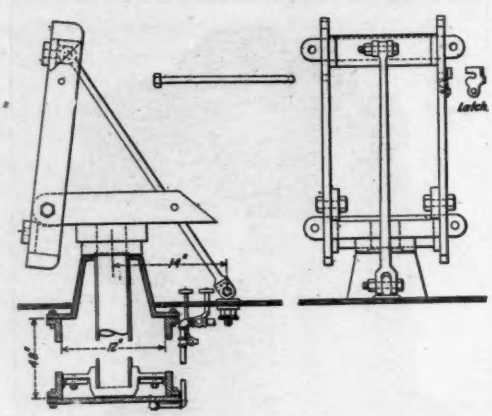


FIG. 2. SKETCH OF TABLE

sor rest horizontally as shown in Fig. 3. The table is then locked by means of a long pin extending through the frame at the top of the plunger. The arm is removed so it will be out of the way of the repair man. Before going ahead with the repair work, a sheet iron sleeve is put around the piston rod, and the cylinder air pressure released. The sleeve then holds the pump at the required height and prevents waste due to air leakage by the cylinder packing leather. If more convenient for the workman, sleeves of different lengths may be provided, which with the arm attached will hold the compressor at any angle desired, and by providing auxiliary brackets which may be applied to the table it may be used for making repairs to all sizes of compressors. The piston rod is turned to a loose fit in the cylinder sleeve, as of course there is never any air pressure above the piston. The cylinder used was an engine-truck, pit-jack cylinder 12-in. dia. and 48-in. stroke.

The use of this table does away with the necessity for air hoists, runways, chain falls or blocking. There are no legs to get in the way of the repair man and the compressor may be set to work upon at any height and any angle. Also on account of the whole arrangement being rigid, bolts and nuts, etc., may be tightened up with all the force required. All of these advantages and good features combine to make a repair table which has given good satisfaction at the Bluefield shops, and in fact have actually increased the output or the number of compressors repaired per month.

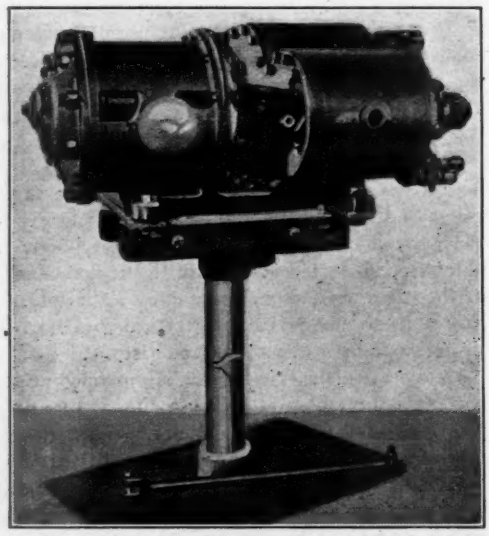


FIG. 3. READY TO BE OVERHAULED

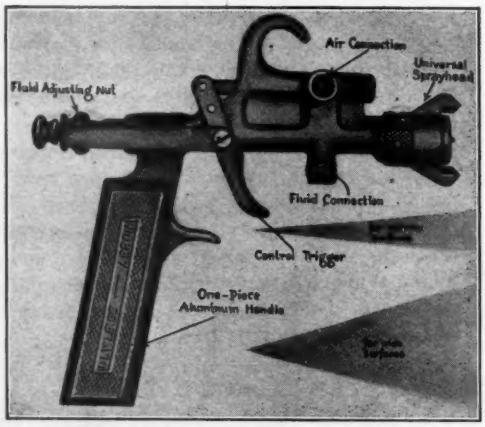


FIG. I

THE AERON PAINT SPRAYING SYSTEM

Among the various methods of applying paint in the form of spray with compressed air as the impelling medium is now to be included in the Aeron system developed by the De Wilbirs Manufacturing Company, Toledo, Ohio.

The responsible portion of the apparatus employed is illustrated in Fig. 1. The nozzle has a pistol grip with the control trigger always under the operator's finger and within four inches of the spray head. The delivery of the spray head gives a thin, flat flow which may be either horizontal or vertical, and wide or narrow according to the requirements of the work.

FIG. 2

There is a paint tank of suitable capacity with regulating head inlet connected by ½ in. air hose to the air supply. One or more nozzles may be connected to the tank by ⅜-in. hose and with a pressure regulator and the fluid adjusting nut on the nozzle the flow is controlled to meet varying conditions of size or nozzle, viscosity of paint, height of delivery, etc. These sprayers are in successful use for a variety of work on railroads and elsewhere. Fig. 2 shows the operation of stenciling the lettering on a freight car and Fig. 3 shows, not very clearly, the painting of the truck.

HEATING OVERDONE

It is stated that a means has been discovered for keeping airmen warm at great altitudes by providing them with electrically-heated clothing. Should this become an easy applied system we may do away with heating in our buildings, as our collars, handkerchiefs, underclothing, and other garments may supply us with all we need, says a note in the *Builder*. We may in the future be as comfortable with the temperature below zero as we are now in a well-heated building, and the bath of the future may be warmed to any desired heat if we place it in the neighborhood of a well-filled ward-robe.

If we want to eat an ice it may be necessary partially to undress, since the proximity of a well-dressed man or woman may reduce the ice to liquid before we can eat it. Assuming the control of temperature to be within our grasp it is possible we shall have automatic contrivances by which our clothing will give out a greater or less degree of heat. A suit will be guaranteed to preserve a temperature of 60 deg. for the wearer, the outer air being anywhere between 16 deg. and 40 deg. A suit to give a greater temperature would presumably cost more, irrespective of material. When the discovery has been fully developed the heating engineer will find his occupation gone.—*The Engineer.*

FIG. 3

ALL THE WIRE GAGES

The Bureau of Standards of the Department of Commerce has issued a new publication entitled "Combined Tables of Sizes in the Principal Wire Gages" (Circular 67), this table combining in one series the sizes in the American (B. & S.), Steel, Birmingham (Stub's), British Standard and Metric Wire gages, arranged in order of diameters or sizes. It gives the diameters of all of the gage numbers in these five systems, in mils, inches, and millimeters, also the cross-sections in square mils, circular mils, square inches and square millimeters. This paper is now ready for distribution, and copies may be obtained upon application to the Bureau of Standards, Washington.

Canadian manufacturers now produce 800,000 complete shells every week, which is more than was produced, before the war, by any nation except Germany.

PORTABLE AIR COMPRESSOR FOR ELECTRIC RAILWAYS

The half-tone above shows a machine in service which saves a large amount of manual labor, a motor driven air compressor mounted on a standard gage truck and operated from the street trolley circuit. It supplies the motive power for the tampers, track drills, chipping hammers for toothing out bricks, air blasts for cleaning rust from structural steel, and many other pneumatic tools found serviceable on track and road work.

The outfit consists of an 8 by 6 inch Ingersoll-Rand compressor driven by a 15 H. P. 550 volt Westinghouse direct current motor with starting rheostal, knife switch and fuses. It is hauled to the job by a trolley car and when connection is made to the trolley wire, it is ready for use. Two tie tampers, chipping hammers, or other tools can be used at the same time. Four small wheels under the truck at right angles to the track-wheels, permit the outfit to be run off the track on heavy timbers.

In a test made under continuous traffic conditions it was found that the cost of the tamping with this machine was one-half that of hand tamping, and better results were obtained, as no second tamping was required on account of settlement under traffic. Further, it was found that two men with the pneumatic tampers could do the work of ten laborers.

Equally satisfactory results were obtained in tearing up concrete, as shown above, in clearing the rust from bridge rollers and seats, drilling bolt and tie rod holes, picketing and cleansing bricks, etc.

COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Established 1896

W. L. SAUNDERS, - - - Editor
FRANK RICHARDS, - Managing Editor
CHAS. A. HIRSCHBERG, - Business Manager
W. C. LAROS, - - Circulation Manager

PUBLISHED MONTHLY BY THE
Compressed Air Magazine Company
Easton, Pa.

New York Office—11 Broadway.
London Office—165 Queen Victoria Street.

Subscription, including postage, United States and Mexico, $1.00 a year. Canada and abroad, $1.50 a year. Single copies, 10 cents.
Those who fail to receive papers promptly will please notify us at once.
Advertising rates furnished on application.

We invite correspondence from engineers, contractors, inventors and others interested in compressed air.

Vol. XXIII. APRIL, 1918. No. 4

CONTENTS

Compressed Air in the War..... 8707
N. Y. City a School for Mining Engineers 8709
Air Receiver Explosions..... 8709
Making the Ship Unsinkable..... 8711
Gibbs Oxygen Rescue Apparatus..... 8714
Compressed Air for Cleaning Motors.. 8716
Sharpening Mine Drill Steel..... 8716
Air Operated Fire Doors..... 8718
Danger of Oxygen Rescue Apparatus... 8720
Air Driven Emery Grinder..... 8721
Air Blast for Hardening Ice Cream.... 8721
Canvas Tubing for Mine Ventilation.... 8722
Air Brake Compressor Repair Table.... 8725
Aeron Paint Spraying System..... 8726
Heating Overdone..... 8727
All the Wire Gages..... 8727
Portable Compressor for Street Railways 8728
The Buoyancy Boxes..... 8729
The Tanks 8730
Workers Wanted for Aviation..... 8731
War Fuel..... 8732
Notes 8733
Patents 8735

The Treasury of the United States has a great deal of money to raise and it can not be raised by bankers alone, says Secretary McAdoo. The banks of this country can not alone sustain America's needs in this war and extend to our allies the essential aid which they must have to continue the war. The rich of this country can not do it alone; the men of this country can not do it alone; the women of this country can not do it alone; but all of us, the people of the United States, disregarding partisanship, forgetting selfish interests, thinking only of the supremacy of right and determined to vindicate the majesty of American ideals and secure the safety of America and civilization, can do the great and splendid work which God has called upon us to do.

THE BUOYANCY BOXES

Notwithstanding the fluctuations of our hopes and the recurring assurances of the overcoming of the submarine and its deadly torpedo, the menace is still most formidable and the actual destruction little checked. There can be no hope of any satisfactory ending of the war while the submarine still flourishes.

There can also be no hope that the submarine can be annihilated and driven from the seas by any monstrous and overwhelming invention. Anything with any promise of minimizing the destructive effects of the torpedo or the floating mine is to be accepted for what it may be worth, and that, we take it, is the status of the buoyancy boxes

This levitation device for keeping merchant ships afloat after being torpedoed is now sufficiently understood by the public and little more is to be told than is contained in the article in our present issue. Whatever may be the merits and whatever may be the ultimate success of the device it comes to us in the way such an invention should come: from one who knows much rather than from one who knows little about the actual requirements and the practical conditions which must be met. Mr. Donnelly is a marine engineer of high standing and large experience, and such as he should be the one most likely to be able to

suggest the means of solution or even partial solution of the problem.

There is much satisfaction to be found in the knowledge that the device is in the way of immediate demonstration. The thing to a considerable extent demonstrates itself, and no drydock trials, that have been suggested, or anything of that kind could give much additional assurance.

The only way to certainly prove the practical saving power of the buoyancy boxes is to have the Lucia go into regular service as soon and as actively as possible, and even then we can hardly say that she should seek the most dangerous waters, or put herself in the way to actually invite attack, but she should take her chances and results might be expected to follow.

Notwithstanding the publicity which has been given to the equipping of the Lucia, it would seem that her location and movements in the near future should be as secret as possible, and so we may not expect to know much of her comings and goings, but we must continue to wish her good luck, and if there should be full warrant that the buoyancy boxes are of saving efficiency the equipping of other ships with them could be accomplished more quickly than could any other arrangement thus far proposed.

With regard to this invention as applied upon this particular ship, our attitude is certainly embarrassing and not clearly definable. It would not be easy to say just what we would wish. Certainly we would not wish to have her struck and sunk. Our confidence may be far from absolute that she could not be struck so that she would certainly sink. We can only say that we would wish that something might happen to satisfy us all.

THE TANKS*

On a certain Friday in September, 1916, after two years of fighting, when it might have been thought that human ingenuity in the art of killing had been exhausted, a fresh engine of war was suddenly sprung upon a world sick of hearing of new methods of slaughter. A day or two later, so soon as the newspapers were able to give some information about this development, the word "Tank" was on all British lips, and since that moment has probably been spoken, written and printed more often than during the whole previous period since its incorporation into the English language.

A word of general description and a few more upon the functions of the Tanks. They are powerfully-engined armed automobiles, enclosed in a bullet-proof casing for the protection of their crews. Propelled on the caterpillar principle, they possess considerable powers of travelling over rough ground, both in crossing trenches, craters, and other cavities, and climbing over raised obstacles, such as parapets; can tear their way without difficulty through wire entanglements, can uproot largish trees, and can throw down the walls of ordinary dwelling houses. Nevertheless, in spite of their elemental strength and apparent clumsiness, in the hands of skilled drivers they are as docile as trained elephants under their own mahouts.

They are divided into males and females. The male is par excellence the machine-gun hunter and destroyer. He carries light, quick-firing guns capable of firing shells, and is intended to be to the machine-gun what the torpedo-boat destroyer was designed to be to the torpedo boat, or the lady-bird is supposed to be to the aphis. The female, which, in accordance with the laws of Nature, is the man-killer, carries nothing but machine-guns for employment against the enemy personnel. Her special role is to keep down hostile rifle fire, to beat back counter-attacks and rushes of infantry, and to act generally as a consort to her lord and master.

Both sexes, however, are heavy weights endowed with great brute force, and share, in common, the attribute of being able to roll out and flatten machine-guns and their emplacements. Both, therefore, act as protectors to infantry, insomuch as they can destroy or "blanket" the one thing which has, so far, proved its greatest bugbear in the attack. Moreover, every Tank that goes forward, whether actually moving or disabled, assists the infantry near it in another way. It bulks above them and is the centre of attraction. It acts as a magnet for the bullets of the hostile machine-guns, and collects them to itself as Arnold von Winkelried is supposed in 1386 to have drawn to his own body the spears of the Austrians at the battle of Sempach. Every bullet that clangs against its steel

*From an admirable paper by Colonel E. D. Swinton, C. B., D. S. O., Royal Engineers. originally printed in *The World's Work*.

sides is one less aimed at the infantry. Every silvery star splashed on its hide is the signature of one that has not drilled its way through the body of an infantry soldier.

To be the nurse, protector and backer of the attacking infantry, who, in the vernacular, "always get it in the neck," was the motive underlying the action of the new arm. As it was expressed in the exhortation given to the officers and men going forth to take their machines into battle for the first time, whatever mistakes might be made, whatever mischances might befall, if the Tanks gave reason for their comrades on foot to thank God for their presence, they would have justified their existence.

That the Germans appreciate the significance of the new development is clear from the instructions issued, and the elaborate protective measures taken by them. And in spite of the ridicule usually poured on the new weapon by their newspapers—the object of which is plain—articles do occasionally appear which sound another note. For instance, Lieutenant-General Baron von Ardenne stated in the "Berliner Tageblatt" that:

"These powerful armoured cars, which were first used by the British, are undoubtedly the most wonderful weapons which modern tactics have revealed in warfare. . . ."

A parting message, and a grip from a friendly hand. This little book may perhaps be read by some of the "boys" from Massachusetts, Oregon, Texas, Pennsylvania, or other States of the Union, who, as members of the infantry of the United States army, may find themselves in the not distant future scrambling across No Man's Land alongside their comrades of the Allied forces, who have already "been over." For them it may perhaps be permitted without presumption to add a word of counsel from one who, though not an infantry soldier, knows something about it. To the time-worn advice of: "Johnnie, get your gun," he would merely add: "And bring your Tanks."

WORKERS WANTED FOR THE AVIATION SERVICE

The Signal Corps authorizes the following statement:

Ten thousand machinists, mechanics, chauffeurs, and other skilled workers are needed at once by the Aviation Section, Signal Corps.

The present call for 10,000 men is to fill an immediate need and may be regarded as the precursor of others as the service is being built up. Even at that the actual strength of the service today is over one hundred times what it was on April first last year.

The dependence of the Air Service on the most highly skilled men is being brought out more emphatically with every week of development. Where in the first rush there was little experience to indicate this fact, it has since developed that practically 98 men out of every 100 in the service must be skilled in some branch of work.

Airplane work has been wholly new and unfamiliar to American mechanics, who have been taken from other trades and converted hastily into workers on the most delicate kinds of jobs. It has been necessary for both officers and men to learn very largely by experience. At the same time a degree of care and attention not usually associated with American quantity production and methods has been required, as great watchfulness is essential to prevent any plane leaving the ground in imperfect condition.

Secretary Baker recently expressed this situation as follows:

"The great problem now remaining is to secure the thousands of skilled mechanics, engine men, motor repair men, wood and metal workers needed to keep the planes always in perfect condition. This great engineering and mechanical force at the airdromes, flying fields and repair depots, both here and behind the lines in France, is a vital industrial link in the chain of air supremacy. Without them the planes turned out would be useless and the flyers helpless."

Men registered in the draft may be inducted into this service by applying to their Local Draft Board. Men not registered may enlist at any Recruiting Office. Further information may be had by applying to the Air Division, Personal Department, Washington, D. C. In either case they will be sent to San Antonia, Texas, for segregation by trades, followed by a brief course of instruction at the flying fields or at various factories and organized into squadrons mostly for service overseas.

The present call is especially for: Machinists, auto mechanics, engine repairmen, gunsmiths, chauffeurs, carpenters, blacksmiths, tinsmiths, cabinet-markers, electricians, copper-

smiths, sheet metal workers, propeller makers, wireless operators and constructors, tailors, tent-makers, sail-makers, truckmasters, vulcanizers, welders, and makers, repairers and installers of: Magnetos, ignition systems, cameras, watches and clocks, instruments and typewriters.

WAR FUEL

"If, according to Dr. Burton, chemist of the Standard Oil Company, the 1917 production of gasoline will be 2,500,000,000 gallons, of which he estimates 2,000,000,000 gallons will be required for American automobiles, it follows that but 500,000,000 gallons will be available for use by military trucks and for export to the allies," says F. Nelson Carle, former secretary of the Motor Truck Club of America.

"With all due respect to so eminent an authority, I venture to raise the point that nearer 50 per cent. of our next two years' production of gasoline will be required directly or indirectly for war purposes. Fortunately for the passenger car owner, other fuels are being adapted to the use of farm tractors and gas engines so these agricultural necessities will not compete with him for fuel as heretofore.

"But what about the submarine chaser, the gas-driven scout cruiser and the motor boat patrol? A good, big 'chaser' of the type now building, perhaps by the hundreds, certainly by the score, has two and in some cases three 250-horsepower motors which consume, in action, 30 gallons of gasoline per hour per motor. If we have to supply fuel for such boats abroad as well as in our own waters, 500,000,000 gallons will not supply such thirsty hornets throughout the war without starving either the 70,000 motor trucks needed by the army or the 60-horsepower touring car.

"Fortunately millions upon millions of gasoline units can be conserved for needed tasks through the use of electricity as a fuel, particularly in city trucking. A large proportion of electricity is made by water power, so that even coal is not needed to increase the supply of this fuel in some sections. Granted coal is used, the cost of industrial electricity is so low that it forms one of the cheapest means of propelling motor-driven city vehicles.

"The war practically denuded European cities of petrol vehicles in the first year of the conflict, and the relatively small number of commercial electrics then available were in great demand, particularly as horses had also been commandeered.

"Since that time the demand for electrics has been greatly augmented, resulting in a 600 per cent. increase in England alone. The leading railroads—among them the Midland Railway, which has purchased over 100 electric trucks, many of them American built—have bought heavily. All over Great Britain the demand for electric lorries, and in fairness to all, for steam vehicles, too, is said to be greater than the supply. Gasoline (petrol) vehicles are still being built or imported in large quantities, but almost wholly for military purposes. The mortality among trucks pounding over the shell-shattered roads of France and Belgium is almost unbelievably high.

"Much the same situation obtains in France, Germany and Austria, the electric being given the preference in transporting mail and merchandise about the cities or between industrial centres By its use gasoline is conserved and many wartime economies made possible, among these the utilization of women drivers.

"Even well informed business men do not always understand why electricity used for recharging truck batteries can be purchased for less than the electricity for an office building or residence. The reason is obvious if they will but consider the simplest of laws—commercial demand. When the business day begins facotries, stores, elevators and other units make their requisition upon the 'central station,' as the main plant of the electric light company is called, and by 11.45 a. m. the load has reached a tremendous peak.

"During a short sunlight day, as in December, the demand upon the central station around 5 p. m. is frequently about all the machines that make the energy can stand. There is a small 'valley' during the noon hour, but, generally speaking, all the current manufactured during the day is consumed. Naturally any one adding to the 'day load' as it is called, should almost pay a premium for his current.

"But at night all this is changed. Then many of the big generators are idle, others producing but half their capacity. By midnight a few residences, hotels and electric signs are all that is left to consume current. During the 'off peak' hours, then, say from 7 until 7, the central station is hungry for busi-

ness and the man with an electric truck or a fleet of them with depleted batteries is as welcome as the proverbial spring flowers.

"Then is when he can buy electricity for as low as one-third of what he might pay during the peak hours of current demand. So low is this rate in many cities, including Boston, that sufficient current to keep a 5-ton electric truck running all day can be purchased for what it costs to buy four gallons of gasoline, or to feed a single horse for 24 hours.

"From the standpoint of motor trucking, then, electricity would seem to be the logical fuel for such trucks as confine their activities largely to the city and immediate suburbs. Intelligent conservation of petroleum and its derivatives is as important as that of grains and other products of the soil."

A RED LAMP WITHOUT FLAME

This interesting little lamp works on the incandescent principle, and is specially useful for tourists. Any alcohol lamp, or a small bottle provided with a round wick, is used. The wick is spread out in a bunch just above the opening of the bottle, and when wet with the alcohol, place upon it the Barden "photo-incandescent cone," then light the wick, burn for five minutes, blow out, and the small piece of the substance will continue to absorb the alcohol and burn with a red glow without being consumed.

OIL FOR AIR COMPRESSORS

In the course of a paper on the "Chemistry and Examination of Lubricating Oils" read before the Diesel Engine Users Association, Mr. Elliott A. Evans made some remarks on the quality of oil required for use in air-compressors.

He said that the Pennsylvanian oils are the only ones moderately stable when subjected to the action of highly compressed air, and then only at moderate temperatures. At elevated temperatures the oil cracks, giving rise to lighter oils which in their turn crack into still lighter oils. During the cracking carbon is deposited, and some extremely unstable hydrocarbons, probably of the olefine series, are formed which decompose with explosive violence. It is quite conceivable that the explosion in an air-compressor at Smithfield occurred through the production of these unstable bodies, and that the vapor of the light oils was exploded by their detonation. That the explosion was caused by the ignition of oil fog may be a very convenient working hypothesis, but it is a little difficult to understand how ignition was effected.

BLOWING DUST FROM MACADAM

In preparing macadam roads for the application of tar or oil, it is generally desirable to remove all dust from the top of the road in order to permit the bituminous material to penertate the stone. If a portable air-compressor is available the dust can be blown off the road. This is the best way, for it cleans the upper interstices, while brooming only packs the dust into them. One plan is to attach to the end of the air-hose a T-shaped set of pipes formed of a tee and three pipes, a row of small holes being drilled in line in the two pipes that are fastened in the opposite openings of the tee. This set of pipes is held in the hand or may be fastened under the wagon carrying the air-compressor so as to come an inch or two above the road-surface.

NOTES

Lycopodium is a vegetable material which, before the war, was used for dusting or coating the molds in foundry practice, in order to prevent the sand from clinging to the castings. Lycopodium came exclusively from Russia and there is none available now. Experiments have showed that by a centrifugal process the dust, which is precipitated from the gas exhalations of the drying apparatus in the works where coal or ligite is briquetted, can be used successfully to replace lycopodium. The light particles of dust, which contain a large percentage of paraffin, have the same properties as lycopodium, as may be seen when water is poured upon them.

That there is more money in working for coal companies these days than in some of the learned professions is evidenced by the fact that Dr. Daniel Reese, of Summit Hill, Pa., has closed his dental offices and is now foreman of an anthracite coal stripping at No. 14 colliery.

A walkers' club has been started at Harrisburg, Pa. Every member pledges himself or herself to walk to and from work, if the distance is less than two miles. This pledge is to be kept in all sorts of weather. The move-

ment is another manifestation of the queer turn which the thrift idea has received.

An American painter recently returned from the Orient believes that in the new renaissance in architecture which is to come after the war we are to have concrete skyscrapers brilliant with color. Needless to say, as a substitute for the dull gray of the average concrete construction, "pink tones, little green-shutters, red roofs and purples," as the architect predicts, would certainly be a gay and giddy change and possibly give American architecture a touch of Italy and the Orient.

Most of the artificial colors now produced have no counterpart in nature. The vat dyes, conspicuous since the war by their absence, are faster than anything obtainable commercially from the vegetal world.

The suffocating poison gas first used by the Germans is not chlorine as generally supposed but phosgene, which is a combination of chlorine and carbon monoxide. This powerful gas is an important factor in the manufacture of synthetic colors. Here is a case where a German peace product was immediately available for military offensive.

Aeroplanes for carrying mail are the subject of a call for bids recently issued by the Post-Office Department. The specifications call for five machines, each capable of carrying 300 pounds of mail a distance of not less than 200 miles, non-stop, maximum speed under full load, 100 miles per hour, minimum speed under full load, 45 miles per hour, climbing speed 6000 feet in 10 minutes, equipped with a 150-horse-power motor.

The Institution of Civil Engineers of London, England, on Jan. 2 completed the hundredth year of its existence, having been established in 1818 at a meeting of eight engineers at the Kendal Coffee House in Fleet Street. At the meeting of the institution on Jan. 8 a statement commemorative of the founding of the institution was presented, war-time conditions precluding more formal celebration of the centenary.

Heavy pneumatic hammers were used to rivet circular reinforcement sleeves to the outside of a 48 to 54-in. pressure pipe for the Jordan river hydroelectric plant at Vancouver Island, B. C., after the pipe had been connected in the trenches. The riveting was so heavy that it was necessary to relieve the operators by providing means to hold the hammers in position while the rivets were driven. This was successfully accomplished by attaching two heavy spiral springs to a collar clamped on the hammer and to opposite ends of an adjustable chain encircling the pipe and thus holding the hammer in position under tension making it necessary to only guide and control it.

A fireman went to his chief and said, "I am saving you a ton of coal a day over what you have been burning, and I think I should have more pay." The chief replied, "If you are not shoveling as much coal as did the old fireman, you are doing less work, so you should not ask more pay for less work." There are such men in the world.

A new metal known by the registered name of Bario has been put upon the market by the Bario Metal Corporation, New York, as a heat and acid-resisting material. The manufacturers claim that this is the only commercial metal of its kind that does not rust, tarnish, corrode or deteriorate. It is, they state, non-magnetic and remains clean and bright and is not attacked by sulphuric, nitric or muriatic acids, resembling in this respect gold and platinum. The melting point of Bario is high, beginning at 3100 deg. Fahr. and increasing according to the grade of metal mixture used. It is manufactured in nine different grades.

In one of his journals, Camille Flammarion gives the heights at which sounds from the earth are heard from balloons. The shout of a man was heard distinctly at the height of 1600 ft., the sharp note of a mole-cricket at 2500 ft., and the croaking of frogs in a morass at 3000 ft. At 3255 ft. a man's voice and the rolling of a cart were distinguished; at 4550 ft. the roll of a drum and the music of an orchestra; at 5000 ft. the crowing of a cock, the sound of a church bell, and sometimes the shouting of men and women. Nine hundred feet higher still he heard the report of a musket and the barking of a dog. The noise of a

railway train penetrated to a height of 8200 ft., and the whistle of a locomotive engine to nearly 10,000 ft.

A world's flying height record of 23,048 ft., with a passenger aboard, attained in 1 h. 3 min., has been established by Flight-Lieut. Francesco Brak Papa, of the Italian Army on a Sia-Fiat biplane. According to the *Autocar*, the flight was made from the Turin aerodrome on December 14th, 1917, the machine carrying a useful load of 792 lb., and was officially observed. The rate of climbing was: 6,561 ft. in 5 min., 13,123 ft. in 15 min., 19,685 ft. in 37 min. 30 sec., 21,325 ft. in 45 min., and the maximum height of 23,048 ft. in just over the hour. This record performance was made with a 300 horse-power six-cylinder Fiat water-cooled engine, of the same type as that used for the flight from Turin to London. The previous height record with a passenger was 21,161 ft., made by the same pilot.

The United States Lighthouse Service is charged with the maintenance of aids to navigation along 47,192 statute miles of coast line and river channel. On June 30th, 1917, there were 5796 persons employed in the Lighthouse Service, including 122 in the teachnical force, 149 in the clerical force, and 5525 employees connected with depots, lighthouses, and vessels. During the fiscal year there was a net increase of 275 in the total number of aids maintained, the total at the end of the year being 15,223. Of them 5420 are lights of all classes and 588 are fog signals. The total number of aids in Alaska, comprising lights, fog signals, buoys and daymarks in commission at the close of the fiscal year was 416, including 159 lighted aids. During the fiscal year 1917 services in saving life and property were rendered and acts of heroism performed by employees of the Lighthouse Service on 160 occasions.

The Press Censor and we are very good friends, and he will forgive us for repeating a good little story at his expense. The National Ordnance Factory, of Leeds, issued, some time ago, an excellent and original souvenir, called the "Shell Magazine." An ingenious contributor wrote for it a poem on the familiar lines of "The House that Jack Built." It began: "This is the shell from Newlay; this is the fuse they always use in the shell that comes from Newlay," and so on. Now the Censor has made a rule that the site of a munition works must never be mentioned, so whenever he came to Newlay in the "poem" he struck it out and replaced it by "a factory." The result can be imagined. "This is the shell from a factory; this is the fuse they always use in the shell that comes from a factory," etc. Providentially, a big man at "munitions"—as the telephone girls call it—with a large poetic-sense was found to argue with the Censor, and the Censor gracefully gave way in deference to Art.—*The Engineer*, London.

A new record was made recently in the time consumed by a vessel in passing through the Panama canal. The former record was 5 hours 45 minutes, which was reduced to 4 hours 13 minutes by a northbound (Pacific to Atlantic) ship. Later, the record was again lowered by a vessel going south, which made the trip in 4 hours 10 minutes.

Next to Buffalo, no large city in America wastes as much water as Chicago with its 260 gal. per person per day. New York City uses only 101 gal. per person per day.

LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

JANUARY 29.

1,254,645. TRAIN-STOP. Willoughby Moulton Avery and John Bingham Booth, Greensboro, N. C.

1,254,650. RECIRCULATION SYSTEM. Chas. Bollinger, Chicago, Ill.

1,254,678. AIR-BRAKE APPLIANCE. Frank Goff, Camden, N. J.

1,254,693. METHOD OF COMPRESSING AN ELASTIC FLUID. Herbert Alfred Humphrey, Westminster, London, England.

1. The method of compressing an elastic fluid by means of liquid descending from a higher to a lower level or pressure, which consists in permitting a flow of said liquid until it attains velocity, then utilizing the momentum of the liquid partly to compress and deliver compressed elastic fluid, and partly to store energy in an elastic cushion to produce a reverse movement of the liquid and thus cause a fresh charge of elastic fluid to enter the region of compression.

1,254,781. VALVE FOR AIR-COMPRESSORS AND THE LIKE. George K. Davol, San Francisco, Cal.

1,254,834. SPRAYING APPARATUS. William P. Mott, Chicago, Ill.

1,254,921. AIR-SUPPLY TANK. Henry J. Meengs, Vriesland, Mich.

1,254,951. FLUID-OPERATED CLUTCH. Chas. M. Ward, Cleveland, Ohio.

1,255,018. PROCESS AND APPARATUS FOR THE SEPARATION OF OILS AND GASES. Philip Jones, Santa Maria, Cal.
1,255,063. DRAFT-GAGE. William H. Stevens, Altoona, Pa.
1,255,105. FLYING-MACHINE. Michael F. Morrissey, Muskegon, Mich.

FEBRUARY 5

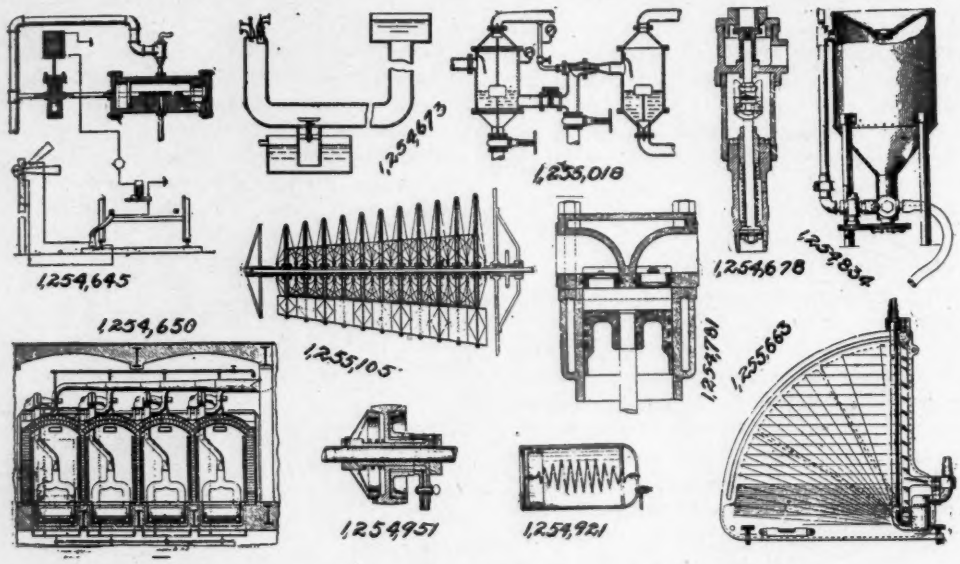
1,255,130. SIPHONIC SYSTEM. Delavan V. Burrell, Rocky Ford, Colo.
1,255,141. MILKING MACHINERY. Norman John Daysh, Poughkeepsie, N. Y.
1,255,175. VACUUM-CLEANER. John Blake Kellogg, Orange, N. J.
1,255,186. MILKING - MACHINE CLUSTER. Meredith Leitch, Poughkeepsie, N. Y.
1,255,239. MILKING - MACHINE. Sebastian Sis, St. Paul, Minn.
1,255,278. AIR COMPRESSOR OR MOTOR. Robert G. Battin, Kansas City, Mo.

FEBRUARY 12

1,255,843. DRYING APPARATUS. John B. Adt, Baltimore, Md.

1. In a drying apparatus, a rotary drum having a material inlet and an air outlet at one end and a material outlet at the opposite end, an air-expansion chamber into which the outlet end of the drum extends and into which it opens, a heating jacket surrounding the drum and opening into the air-expansion chamber, said jacket being carried by the drum and rotatable therewith, an air heater, and means for delivering air from said heater into the aforesaid jacket.

1,255,855. AIR CHAMBER AND DRAIN STORAGE PUMP. Carl F. Brandenberger and Martin W. Reuther, Fort Madison, Iowa.
1,255,875. AIR-PUMP. Arthur G. R. Guerard, Mulberry, Fla.
1,255,901. SHUTTER - ACTUATING DEVICE. Paul J. Marks, Rochester, N. Y.



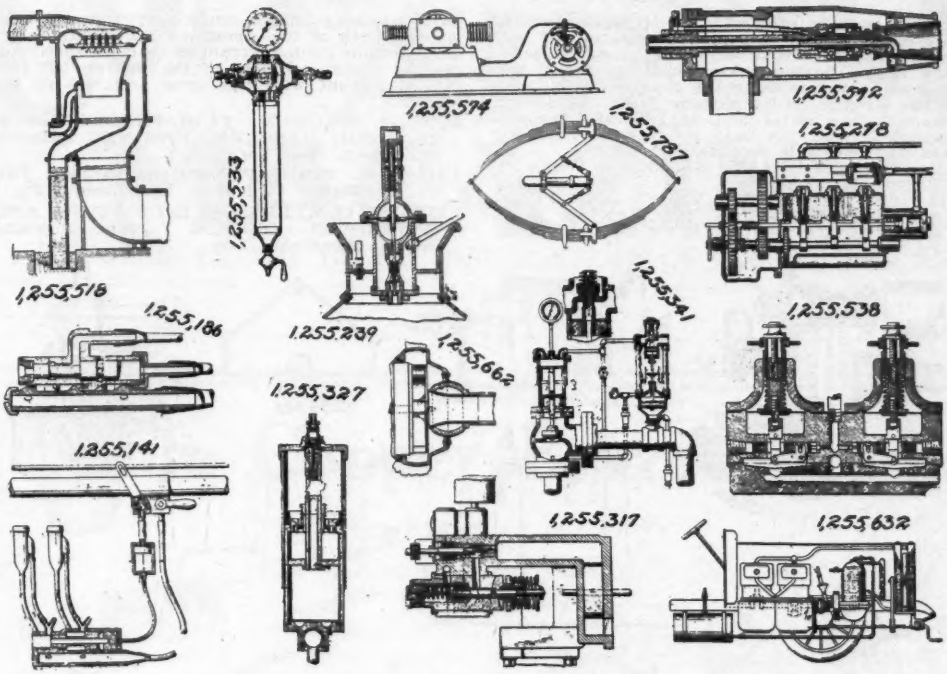
PNEUMATIC PATENTS JANUARY 29.

1,255,317. AIR-CONTROLLING MECHANISM FOR GLASS-BLOWING MACHINES. August Kadow, Toledo, Ohio.
1,255,327. AIR-CUSHION. George B. Maegly, Kansas City, Mo.
1,255,341. PNEUMATIC PUMP. Justin E. Russell, Chicago, Ill.
1,255,449. CRUDE-OIL ATOMIZER AND AIR-MIXER. Duncan C. McCalg, Vancouver, British Columbia, Canada.
1,255,518. BAROMETRIC CONDENSER. Raymond N. Ehrhart, Edgewood, Pa.
1,255,533. AIR-MODIFIER. Stephin J. Heinrich, Newton Highlands, Mass.
1,255,538. AUTOMATIC PRESSURE - REGULATING VALVE. John C. Kitton, Chicago, Ill.
1,255,574. PRESSURE-RELEASE. Rollin L. Bacher, Cleveland, Ohio.
1,255,592. CENTRIFUGAL OIL-BURNER. Milton A. Fesler, San Francisco, Cal.
1,255,632. AUTOMOBILE AIR-COMPRESSOR. Loreto Poccia, Mamaroneck, N. Y.
1,255,662. SUCTION-CLEANER. Joseph L. Sullivan, Cleveland, Ohio.
1,255,694. AIR-COMPRESSOR. Alvin R. Berck and Fred Tjaden, Hastings, Nebr.
1,255,787. FLUID SHOCK-ABSORBER. Francis V. Phillips, Orlando, Fla.
1,255,949. PNEUMATIC CONVEYER. Theodore G. Thormodson, Hanska, Minn.
1,255,958. CAR-DOOR-OPERATING DEVICE. Walter V. Turner, Wilkinsburg, and William M. Cady, Edgewood, Pa.
1,255,972. PUMP AND PUMPING SYSTEM. Burton S. Aikman, Milwaukee, Wis.

1. In a pump, the combination of a diaphragm, a cylinder head member having a chamber on one side of the diaphragm, said head having a passageway communicating with the chamber, a compressed air inlet port opening into said passageway, an exhaust port opening into said passageway, a valve body adapted to obstruct said ports one at a time, the exhaust port having a substantially larger area than the admission port to produce a seating pressure upon the valve and means for shifting the valve from one port to the other.

1,256,017. APPARATUS FOR TREATING FLOUR. George J. Hicks, Saginaw, Mich.

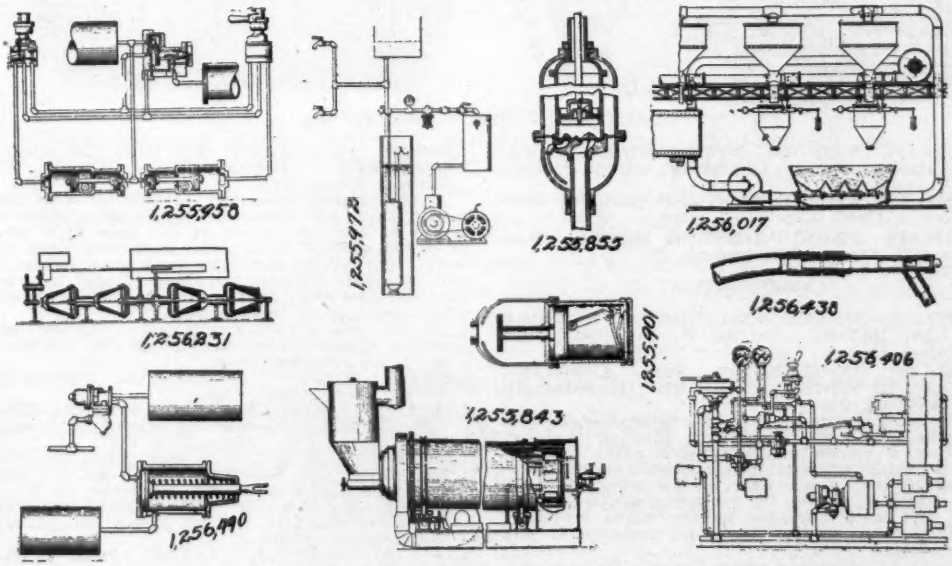
1. In an apparatus for treating flour, the combination with a bottom-discharge storage bin having a plurality of separate discharge outlets provided with closers, of an air tank, means for holding open all of said closers, and a blower for forcing air from said tank through flour flowing from the discharge of said bin.



PNEUMATIC PATENTS FEBRUARY 5.

1,256,231. METHOD OF IMPARTING, CONVERTING AND UTILIZING ENERGY IN CONNECTION WITH A COMPRESSIBLE FLUID MEDIUM AND APPARATUS FOR EMPLOYING SAID METHOD. Robert H. Hough, Philadelphia, Pa.

1. The method of converting kinetic energy of the mass velocity of a moving stream of an adiabetically expanding gas, and potential energy thereof into the kinetic energy of a rotatable turbo-member; which consists in permitting the progressive adiabetic expansion of the moving gas in skin frictional contact with the surface of said member; progressively conduct-



PNEUMATIC PATENTS FEBRUARY 12.

ing the moving stream in a delimited path of said contact, from a region of rotation of said member having relatively high linear velocity, to a region having lower linear velocity; and progressively increasing the cross sectional area of the stream, in its passage from the former region to the latter one, in substantial correspondence with the said progressive adiabetic expansion and said reduction of velocity.

1,256,406. AIR-BRAKE SYSTEM. Willis C. Webster, Dubois, Pa.

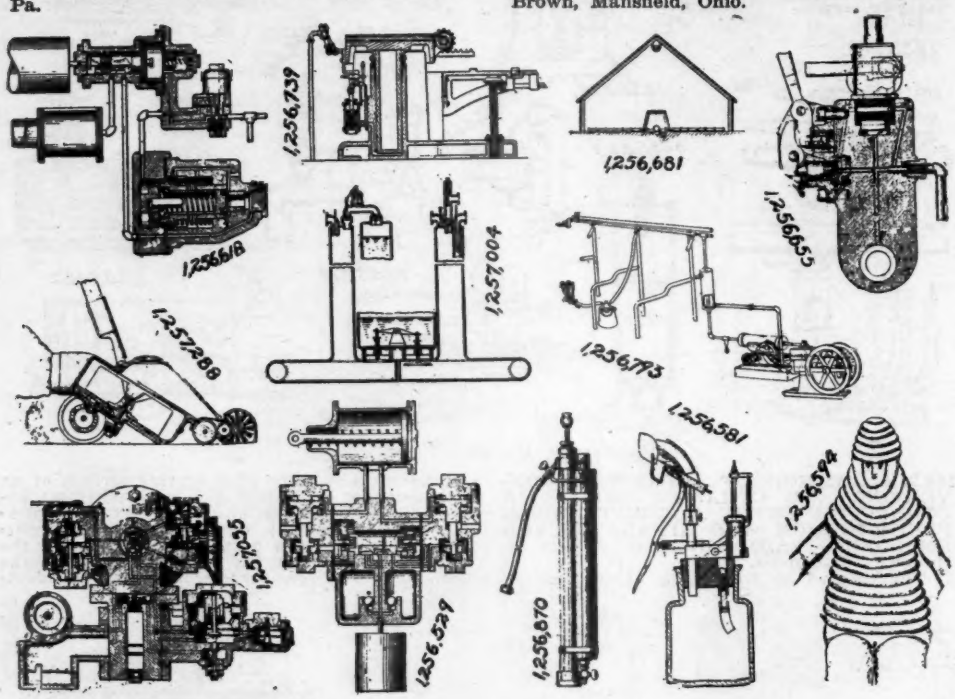
1,256,407. ENGINEER'S VALVE AND PRESSURE-CONTROLLING MECHANISM FOR AIR-BRAKES. Willis C. Webster, Dubois, Pa.

garment, comprising a trunk portion and a head portion, both of these portions being surrounded by inflatable tubing arranged in coils surrounding the trunk and head of the wearer, but free of engagement with the arms and legs of the wearer.

1,256,610. VACUUM FUEL-FEEDING SYSTEM FOR GASOLENE-ENGINES. Harold C. Suckert, New York, N. Y.

1,256,617-8. FLUID-PRESSURE BRAKE DEVICE. Walter V. Turner, Wilkinsburg, Pa.

1,256,655. COMPRESSOR INDICATING AND RECORDING DEVICE. John Rowland Brown, Mansfield, Ohio.



PNEUMATIC PATENTS FEBRUARY 19.

1,256,438. VACUUM COTTON-PICKING MACHINE. Bailey E. Chaney, Corpus Christi, Texas.

1,256,468. AIR-CONTROL GOVERNOR. Robert A. Gally, Cincinnati, Ohio.

1,256,490. FLUID-PRESSURE BRAKE. Walter V. Turner, Wilkinsburg, Pa.

FEBRUARY 19

1,256,529. BRAKE - CYLINDER - PRESSURE REGULATOR. Patrick H. Donovan, Edgewood, Pa.

1,256,581. INSTRUMENT FOR APPLYING LIQUID FINISH TO SHOES. Henri Marois, Lewiston, Me.

1. In a device of the character described, a liquid container, a feed pipe entering the container, a brush in said pipe, a guide adjacent said brush adapted to be moved manually in contact with some part of the work, a valve in said pipe, means for operating said valve and an air pump operable by the valve operating means for supplying air under pressure to said container.

1,256,594. SAFETY-SUIT FOR AVIATORS. Augusto Rodal, Habana, Cuba.

1. A sleeveless and trouserless sweater-like

1,256,681. PNEUMATIC METHOD OF VENTILATING COTTON-SEED. Alfred W. French, Piqua, Ohio.

1. The herein described method of treating cotton seed, consisting in supplying a volume of air at multiple points at the base of a pile of cotton seed of substantial horizontal area to cause said air to distribute and pass laterally and upwardly through the mass of seed to prevent the seed from heating and to cool any seed which may have become heated.

1,256,739. MOLDING-MACHINE. Chester H. Steele, Quaker City, and Frank H. Scattergood, Georgetown Ohio.

1,256,793. MILKING APPARATUS. Samuel B. Harner, near Xenia, Ohio.

1,256,870. COMBINED PUMP AND FIRE-EXTINGUISHER. George D. Buck, St. Louis, Mo.

1,256,979-80. APPARATUS FOR THE MANUFACTURE OF BLOWN-GLASS ARTICLES. Benjamin Day Chamberlin, Rochester, N. Y.

1,257,004. METHOD OF COMPRESSING ELASTIC FLUID. Herbert Alfred Humphrey, Westminster, England.

1,257,055. TRIPLE VALVE FOR AIR-BRAKES. Willis C. Webster, Dubois, Pa.

1,257,288. SUCTION-CLEANER. James B. Kirby, Cleveland, Ohio.